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New Advertisements.

In the growth of THE ELECTRICAL WORLD in circulation, size and general improvement, the value of its columns for reaching those engaged in electrical pursuits or interested in electrical matters has not failed to be appreciated by advertisers. Readers will find it to their advantage to keep their eyes on the advertising as well as the reading columns. The following are the new advertisements in this issue:

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Vol. IX. NEW YORK, JUNE 4, 1887. No. 23.

INDICATIONS are already numerous that the Electrical Exhibition to be given in this city next Fall by the New York Electrical Society will be far larger and far more important than was at first expected. The exhibits will unquestionably be of the first rank, and the good that will be done to the science and business generally from the familiarity the public will thus obtain with the latest applications of electricity cannot be overestimated.

IT will be seen that the House Fund of the American Institute of Electrical Engineers is growing steadily, and that the movement is receiving support that might well be called remarkable for its unanimity and heartiness. Seeing how much good the Institute can do in a variety of ways, we are glad to record this general willingness to provide it with the required facilities for larger usefulness. The Institute, now in its fourth year, has been gaining from the start in ability to do good, and with a home of its own will be in a position of vantage for executing the many plans it has in hand and in mind.

THE discussion of the proper methods for protecting dynamos from lightning has been taken up by a number of correspondents. While the experience of some is against the use of Mr. Wood's device of connecting only one side of the dynamo to the lightning arrester, that of others is certainly in its favor. A correspondent this week has met with good success using the latter plan, and we consider the matter of sufficient importance to invite further communications on the subject.

WHILE New York City is about to see its hundreds of miles of avenues and streets all lighted by electricity, the other extreme of the same action or development is seen in the efforts being made by small towns and villages all over the country to secure the electric light also. Serviceable as the arc may be in large cities, we do not think it is less so in the dark and deserted streets of lonely suburbs and hamlets, whose residents still stay indoors after dark, as much for security and safety as for any other reason.

To the doubters of the practicability of the electric railway, the array of work accomplished in that direction, both here and abroad, as exemplified in the paper read before the Institute, and printed in this issue, must be a convincing argument. The continuous successful operation of such a road for as long a period as six years in one case, is sufficient evidence of the permanent character and profitableness. The progress of America, in this respect, is particularly gratifying, as showing a wonderfully rapid growth, and opening up the prospect of great future activity. Our columns this week even give evidence of the fact that more extensive projects are now in course of completion. When horse railroad companies without the usual "trials" change over their entire motive power to electricity, it is plain that the stage of experiment is passed, and that of permanence is at hand.

THE laying out of electric lighting plants on the basis of sound commercial investment is excellently well treated in the paper of Mr. J. A. Powers, read before the American Institute of Electrical Engineers. His course in the construction of his own station shows that in respect to economy the same laws apply to electric lighting as to any other business enterprise. The question of the kind of engines to be used has also received intelligent treatment on his part, and his remarks on the reasons which have led him to put in both condensing and high speed engines are very apt. It is the result evidently of a close analysis of the problem, which has no doubt been correctly solved in this case. While Mr. Powers advocated the condensing of high speed engines, where a water supply can be had, he did not state the amount of boiler pressure carried in his station. With high pressures it is usually considered to be of small advantage, especially when feed water heaters are used.

IN a lecture delivered before the Boston Society of Arts last week, Mr. M. M. M. Slattery described the system of distribution by transformers or induction coils, and in the course of his remarks he dwelt upon the fact that experiments have shown that the many rules which guide the manufacturer in the construction of dynamo machines could be applied in the construction of induction coils. In other words, the loss in the copper wire must be as small as possible; and, as in the case of the field of the dynamo, care must be taken to keep well below the saturation of the core, and the magnetic circuit must be as short as possible. As regards regulation, Mr. Slattery points out that, as in the dynamo, it is only a question of putting enough metal into the apparatus, but this must not be carried to such a point as to preclude the use of transformers commercially. The lecturer illustrated by actual experiment the facts brought out, and showed that while coils deficient in iron gave poor regulation, those with ample core regulated well. Missionary lecture work of this nature is not wasted at this time, when the public mind is so eager for information on electrical subjects.

LAST week in a brief hour the whole of the motive power of one of the largest street car lines in this city was wiped out of existence, 1,200 horses dying horribly in the flames of a sudden and unexplained fire. Now that this awful accident has happened, everybody is crying out: "The car stables must go." It sometimes needs a catastrophe of this character to arouse public attention to the need for reform, and there can be no doubt that the Belt Line fire has many lessons to teach, the principal among which is the one that street car stables, no matter how well conducted, are a nuisance in large cities, and should be abolished. The only excuse for them has been that horses were needed to run the cars, because steam was inadmissible. Now, however, the cable system and the electric motor have both demonstrated their great superiority over horseflesh, and electricity has exemplified in various ways its greater economy and flexibility than the cable. We have not the slighest hesitation in affirming, that if electricity is given a fair trial on the Belt Line, it will prove itself adequate to every emergency, and once and for all settle the question as to the right form of power to use for locomotion in large cities.

THE résumé of the results of the brake tests undertaken by the Chicago, Burlington & Quincy Railroad, which is given in another column, shows that in this particular field, as well as in others, electricity will play an important part in the future. Even now it is clear that the best graduation of braking is accomplished by the use of electric devices, and the rapidity with which a train can be brought to a standstill shows in favor of electricity. The manner in which the current shall be generated and the method of its application are, it seems, points still to be determined upon. We may, of couree, use a dynamo for a generator, but batteries have been used on several of the trials. In the latter case both the open and closed circuit systems may be used. In the former case, the battery is only called on for work during the actual period of braking. But on the other hand, it has the disadvantage, not shared in by the latter system, that it gives no indication of irregularity in the condition of the apparatus. Various methods of overcoming this objection are in use, such as the placing of two batteries in opposition, one of which is temporarily thrown out of circuit. Other methods for this purpose will no doubt suggest themselves to our readers.

THE electric current is now employed in so many ways and the paths over which it is conducted are so various that in some cases the question has naturally arisen whether the current might not affect the strength of the metal conductor, where the latter is employed as a structural part. Thus, but recently, we were applied to for information regarding the effect of the current on rails forming part of the circuit of a railway signal system. If the long experience gained with the telegraph, and the still more valuable one of the dynamo with heavy currents, has shown no appreciable effect due to this cause, on conductors properly proportioned, it is safe to assume that none need be apprehended in the future. That eminent authority on the strength of materials, Prof. R. H. Thurston, does not believe that the effect is ever observable, no matter what the time or period of application may be, and that it is probably *nil* on strength, elasticity and durability. While past experience is sufficient to base safe conclusions upon, it might not be uninteresting, however, to determine the point with some certainty. We recall the experiments of Professor Thurston on loaded wires—they extended over years—and would suggest that an analagous test with wires carrying currents might well be undertaken. It might not be uninteresting, too, to investigate the effect of magnetism on the strength of iron and steel.

THE recent and still-continued severe fighting for the electric light contracts for New York City presents many points of interest. One of the most amusing elements of the discussion has been the manner in which the public has been favored by some newspapers with full explanations and statements ex cathedra as to the nature and cost of electric lights. In some respects this free and injudicious handling of the subject may have done harm, but the injury inflicted on the lighting business by its friends and enemies alike is more than counterbalanced by the recent message of the Mayor pronouncing strongly in favor of arc lights for the streets as the best and only proper means of their illumination. Twice Mayor Hewitt, within the last two weeks, has called the attention of the Aldermen to the fact "that illumination by electric lights tended very greatly to the prevention of crime and the preservation of good order in the city.' Coming from the source it does, this will be praise enough, but the Mayor goes on to say: "I am satisfied by further inquiry that we shall save a very large amount annually in the expenses of the police force provided the city is better lighted than it now is. The Commissioners of Police have urged upon me the necessity for increasing the police force of the city, and there is no doubt that early steps will have to be taken in this direction, unless we can render such an increase unnecessary by a better system of lighting the streets at night. * * * * New York will become the most attractive place of residence on this continent." When a mayor of such honesty and sagacity as Mr. Hewitt can speak in this way, it becomes evident that the day is near at hand when every street in the city will be lighted by electricity. Perhaps it is the perception of this fact that has made the various companies interested so eager to get a footing and a franchise, and thus to secure a part of the work. Although the price of an arc light per night may be less than it was, and less than it should be, the value of the circuits upon which those lights are strung seems to increase every year.

The House Fund of the American Institute of Electrical Engineers.

The general interest that is manifested in the action taken by the American Institute of Electrical Engineers, with the view of obtaining a house, similar to that of the American Society of Civil Engineers, shows that the step was timely and well advised. It is recognized that the Institute, in starting this movement, is seeking and furthering no selfish end, but, on the contrary, is aiming to do that which must necessarily promote the general welfare. The only matter for regret is that the Institute should have waited three years in carrying out its declared and well-defined purpose in this matter. However, the delay may have been beneficial in more strongly emphasizing the desirability of having some central library, museum, laboratory, etc., and now that the work has been at last taken in hand, there is no reason why it should not be carried out with great success. As has been before pointed out, while the movement is one in which the members take the leading part, and one from which they will derive much direct good, it is one that must concern all connected with electrical work, as being a step in the direction of rendering the profession more distinctively a separate one, entitled to recognition, and as showing that the developments of electrical application now rank with the foremost industrial departments in importance, stability and growth. The fact that the Institute, with its careful yet liberal scale of membership is open to all who are interested in electricity, and is not an organization from which any worthy person can be excluded by personal jealousies and animosities and even worse influences, is enough to insure it the support of all desiring to see their own sphere of work gaining in weight and consideration, and represented by a national body composed of all the best elements.

We give below the full subscription list to June 1. It will be noted that it has already assumed quite a representative character, including many names of world-wide reputation.

LIST OF CONTRIBUTIONS.

Prof. W. A. Anthony	$ 50
C. S. Bradley	200
W. M. Callender	100
C. A. Cheever	100
W. B. Cleveland	50
Curtis & Crocker	100
T. A. Edison (first)	100
S. D. Field	100
W. K. Freeman	50
G. A. Hamilton	50
F. B. Herzog	250
" (Conditional)	250
C. B. Hotchkiss	200
W. T. Hunt	10
W. J. Johnston	500
E. H. Johnson (first)	100
F. W. Jones	100
Julien Electric Co. (Wm. Bracken, pres.)	100
T. C. Martin (first)	100
Capt. Michaelis, U. S. A	20
J. F. Morrison	200
G. M. Phelps	100
G. M. Phelps, Jr	100
R. W. Pope	100
Pope, Edgecomb & Terry (first)	250
J. Elliot Smith	20
Gerritt Smith	25
F. J. Sprague	50
C. E. Stump	100
W. C. Temple	25
Prof. Elihu Thomson	100
F. R. Upton	50
W. Wallace	100
J. Wetzler	100
S. S. Wheeler	100
Edward Weston	250
Total to June 1	$4,200

It was stated last week that lectures in aid of the House Fund would be delivered by Mr. T. D. Lockwood, Mr. E. H. Johnson, and Prof. Elihu Thomson. Lieut. F. J. Sprague, whose remarkable address before the National Electric Light Association in Philadelphia last February was heard with so much pleasure by all, has kindly consented to add his name to the list of lecturers.

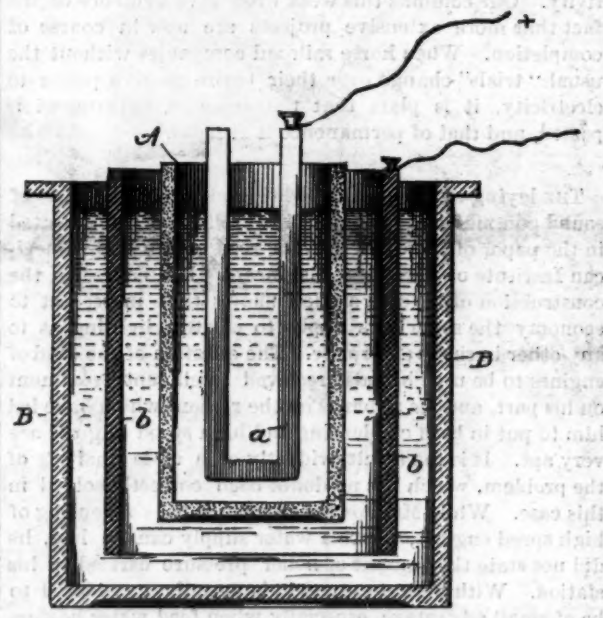
With regard to the work and aims of the Institute, we quote the following from the June number of the New York *Electrician and Electrical Engineer:*

The founders and members of the American Institute of Electrical Engineers have cause for extreme gratification in the work of the annual and general meetings, May 17 and 18. Their gratification will be shared by all interdeste in any way in the development of electrical science or of the useful arts based upon it. The attendance as well as the character of the papers read and of the discussions following, well attest the success of the Institute in drawing together the labors of scientific investigators and practical workers in the field of electric engineering, and illustrate afresh the close interdependence of research in the laboratory and practice in factory or afield, in developing improved methods and results. The astounding rapidity with which electricity has reached out for, taken and held new fields, is a significant, perhaps the most striking, feature in the general advance in the arts of utility so characteristic of the present period. That the American Institute of Electrical Engineers will maintain its part of the work, is shown by its steadily improving record during the three years of its existence; that it will put itself on a firmer basis and augment its usefulness may be confidently expected from the movement so promisingly initiated at the recent meeting towards securing permanent quarters, a home of its own, with an assembly room, sufficient space for a library, reading room, museum, and such other uses as the needs of the Institute will require. The project met with such cordial response, and was so generally supported that its success may be taken as assured. We print elsewhere a list of subscriptions to the house fund up to May 28, amounting to $3,950, a most encouraging beginning. The Council of the Institute took the matter up energetically at a special meeting May 24, appointing a special committee to carry on the work.

A New Primary Battery.

Some time ago we described a battery devised by Dr. Orazio Lugo, of this city, in which the negative element is kept free from deposit of other elemental matter, thus conducing toward a constant electrical energy or volt-ampère; but in electric batteries constructed with their elements in contact with two solutions, one alkaline and the other acid, owing to the great chemical affinity of alkali and acid for each other, the solutions soon become neutralized. Notwithstanding their separation by an inert porous medium, the neutralizing process continues even when the battery is in closed circuit; hence, generally, electric batteries of this kind are not constant in electromotive force.

To avoid this objection, Dr. Lugo has recently devised a method by which, while keeping the negative element free from deposit, and conducing in this way toward constant electrical energy or volt-ampère, he states he obtains a greater electromotive force than heretofore, and at once conserves the battery by preventing interdiffusion of the acid and alkaline solutions.



A NEW PRIMARY BATTERY.

He has discovered, when the elements of an electric battery are respectively in contact with alkaline and acid solutions, that the interdiffusion of the liquids may be almost totally prevented by the addition to the acid of a metallic salt, this interdiffusion being thus prevented whether the battery be in open or closed circuit, and the osmotic action of gas produced when the circuit is closed not being arrested thereby, but taking place freely. Even when the porous medium is filled with a neutral salt, formed by the action of the acid upon the alkali, osmotic action of the gases will still continue.

In one form of his cell, shown in the accompanying illustration, two elements are employed, one being zinc, while the other may be carbon, and these elements are in contact with two liquids, the one being alkaline and the other an acid containing a metallic salt. In a porous cup *A* is the carbon *a*, and this cup contains nitric acid and a solution of nitrate of copper. In the outer jar *B*, generally of glass, is the zinc element *b*, and in this jar is put a solution of a caustic alkali, such as caustic soda. The two elements constituting the battery are thus in contact with three different liquids or solutions.

Dr. Lugo states that he has constructed a battery of amalgamated zinc in a caustic soda solution, of 40° Baumé, in the glass jar, the porous cup containing of nitric acid, of 35° Baumé, two-thirds, and of nitrate of copper solution, of 35° Baumé, one-third, the carbon element being immersed in the acid-copper solution with the following results: electromotive force, 2.5 volts at the start. After having kept the cell short-circuited for two hundred and sixty-four hours it still gave 2.4 volts.

By varying the size of the two elements, the current of this battery can be obtained of the desired quantity as well as by changing the proportions of the nitric acid and the nitrate of copper; the less the quantity of nitrate of copper present the greater being the current and the lower the internal resistance of the battery for given size electrodes. It is well, also, to vary the strength of the alkaline solution in inverse proportion to the density of the acid-salt solution.

Other acids and metallic salts may be used instead of nitric acid and nitrate of copper—such as hydrochloric acid and chloride of copper or sulphuric acid and sulphate of copper, or any of the other nitrates, sulphates, chlorides, or chlorates, preferably in solution with the acid belonging to the metallic salt used.

The electromotive force will vary, of course, according to the salt and acid employed in making up the cell, and also the constancy of the current will depend upon whether the free acid used can dissolve the metal deposited on the carbon element and maintain a free carbon contact while the battery is at work, if a free carbon contact and the highest electromotive force is desired. Sulphate of copper and sulphuric acid will not prevent the deposition of copper on the carbon element without nitric acid being present.

The American Institute Electrical Exhibition.

From what has already transpired since the announcement was made, it is evident that the Electrical Exhibition to be given this Fall in the American Institute Hall by the New York Electrical Society will be one of unusually interesting character. It is plain that the electric motor will take a leading place in the exhibits, and it is, indeed, not unlikely that the universal introduction of the motor for all small power purposes may date definitely from the time of the Exhibition. New systems of lighting are also destined to enjoy a publicity that could only be thus afforded, and the storage battery will also demand no small amount of attention. When it is remembered that the exhibition building is at about the centre of a region with 3,000,000 inhabitants, inside a circle of ten miles radius, and is so convenient for visitors from all parts of the country, it will be seen that better conditions for bringing electrical novelties to notice could not easily be asked or found. As a large number of applications for space have already been made informally, it is well that all who intend exhibiting should signify their intention as soon as possible to Mr. J. Wetzler, Secretary of the Society, 175 Potter Building, or Mr. C. W. Hull, superintendent of the American Institute, Clinton Hall, this city. The following is a copy of the preliminary circular just issued on the subject:

The New York Electrical Society has decided to give an electrical exhibition in this city during the coming fall in the large Exhibition Building of the American Institute.

The exhibition will open Sept. 28 and continue to Dec. 3, and is intended to include all that relates to the science and application of electricity in its broadest sense.

Power will be furnished from existing lines of shafting; also steam from existing pipes, without charge. A ticket will be given for each exhibit without charge, admitting any member of firm making exhibit; also such tickets as may be needed for employés having charge thereof.

No electrical exhibition has ever been held in New York, and it is confidently believed that the one now to be given will attract a large number of visitors, both residents and from other cities.

The American Institute has provided ample means to carry out the designs of the society, which is also assured of the co-operation of the American Institute of Electrical Engineers. Kindly inform the undersigned at once about how much space you will want, which notification will be placed on file as the date of application, each of which will be taken up in due order. Regular application blanks will be forwarded in a few days. It has been specially provided that the electrical exhibits shall not be entered for competition.

In order that the management may make ample provision for all exhibits, it is desirable that they be informed at the earliest possible moment of the intentions of exhibitors and the probable space required. The rates for space will be as follows:

For the first 16 square feet, $10; for each additional square foot, ten cents.

Full details and any desired information can be obtained by addressing the Secretary of the society.

Peculiar Atmospheric Condition.—A very singular atmosphere was felt in the cotton mills, on Thursday of last week, along the New England coast. About 9 o'clock in the morning of Wednesday the humidity in many of the mills went down to about 32, and the different rooms seemed to be perfectly alive with electricity, so much so that it was almost impossible to run the work. Many plans were tried to kill it, but none of them seemed to avail anything. About 2 o'clock Thursday afternoon all at once it passed off, the humidity went up and work began to run again as before. Many of our old manufacturers say they never saw electricity predominate in a mill to anywhere near such an extent as was felt at this time. In New York City, during that time, the air was said to be the dryest ever known.—*Boston Journal of Commerce.*

The Sprague Railway at Richmond, Va.

The progress which is now being made in the conversion of horse roads into electric railways bids fair to make that department a rival in importance to the application of electricity to stationary motive power purposes. One of the most recent changes in this respect is that which has been decided on by the Richmond, Va., Union company, who have contracted with the Sprague Electric Railway and Motor Company to equip 40 cars to run on about 11 miles of road. An overhead conductor will be used to carry the current, and several new devices in this connection will be employed.

The form of truck which will be employed is illustrated in the accompanying engraving. The motors are attached to the axles independently and hung by a spring, so that all jars and sudden strains are avoided. On each end of the motor a 3-inch pinion is keyed, meshing with a 22-inch gear wheel. One of the gear wheels is fixed to the car axle, while the other is attached so as to be adjustable. In this way they can both be made to gear perfectly with the pinions on the motor shaft.

The motors each weigh about 800 pounds and are of 7.5 h. p. each, so that 15 h. p. can be developed if occasion requires. They are coupled in multiple arc and governed from one switch under the control of the driver. The motors are 12 inches deep, 23 inches wide and 44 inches long. At 10 miles an hour, the armatures revolve at 650 revolutions per minute. Work is now rapidly progressing on the 80 motors required, and the line work will soon be undertaken.

The Electrical Industries of Mexico.

BY W. J. JOHNSTON.

3.—*Telephony.*

In addition to the Mexican Telephone Company, which may be called a parent company, there are quite a number of local telephone companies operating in various parts of the Republic under license from the Mexican Company. The principal of these local companies is the Mexican Central, which has exchanges at Guanajuato, San Luis Potosi, Zacatecas and Coretero, and which has for some little time been paying small dividends; the Mexican Northern Company, which has exchanges at Chihuahua and Durango, and the Mexican Peninsular Company, which has exchanges at Merida and Oaxaca.

The Mexican Telephone Company has exchanges in the City of Mexico and in Tacubaya and Guadalupe, a few miles from the capital, and also in Puebla and Guadalajara. The first three of these exchanges are connected by a trunk line. The exchange in the City of Mexico has about 700 subscribers, that in Tacubaya 50 and that in Guadalupe 10, while the exchange in Puebla has 80 and that in Guadalajara 160.

The rates in the City of Mexico are $5 a month for a distance of one kilometre—about ⅝ of a mile—or less from the office; $8 a month for two kilometres from the office, or $10 a month for three or more kilometres from the office. The exchange is centrally located, however, and about two-thirds of the subscribers are within one kilometre of the office. An extra charge of $10 is invariably made in addition to the rental for each instrument installed. The Tacubaya and Guadalupe rates run from $7 to $10 a month. The rate at Puebla is $4 a month, and at Guadalajara it runs from $3 to $4.

The company has been engaged for some time in rebuilding its entire system of lines in the City of Mexico, and also some of its lines outside the city. About half of the reconstruction is now completed. The rest it is thought will be finished in about three months. The new lines are quite an improvement over the old ones, the poles being tall and stately, running from 45 to 75 feet in height, with a few 85-foot poles, and some almost 100 feet high.

In the City of Mexico eight operators are employed during the day and four at night. Tacubaya and Guadalupe have each one operator. Puebla has one operator during the day and one at night, besides Manager P. G. Burgess. Guadalajara has two operators days, and one nights, in addition to Manager C. H. Bosdet.

The switch-board used in the City of Mexico was manufactured by the Utica Fire Alarm Telegraph Company, of Utica, N. Y. The board consists of 400 drops, and to these have been added 300 drops manufactured by the Western Electric Company. The increase in the number of subscribers in the City of Mexico has recently been at the rate of about six or seven a month net. This does not seem to indicate very rapid growth, but Guadalajara and Puebla show even less progress. The annual report presented to the stockholders in April, 1886, showed that there were then 671 subscribers in the City of Mexico, 160 in Guadalajara and 78 in Puebla. It will be seen, therefore, that Guadalajara seems to remain about stationary, while Puebla has only increased its number of subscribers by two during the year.

Mr. M. L. Guiraud, the general manager, and Mr. D. J. Hobart, the superintendent, are the only Americans connected with the company in the City of Mexico; all the other employés are Mexicans. The salaries of these Mexicans are considerably lower than the same class of employés command in the States. For instance, the foreman gets $2 a day; one of the linemen gets $1.50 and three others $1 a day each; four "peones" are employed as ground-men helpers) at fifty cents a day; trouble hunters, of which there are two, get $1.25 and $1.75 respectively; the $1.75 man also acting as an inspector. In addition to these there is an inspector and instrument setter at $1 a day, and also an trouble hunter at Tacubaya at $1 a day. In the other places where the company has exchanges the highest rate paid linemen is $1 a day. The four night operators (boys) in the City of Mexico get $4 a week of seven days. The wages of the day operators (girls) run from $10 to $20 a month. The chief operator gets $28 a month. The operator manager at Tacubaya gets $25 a month, while the operator at Guadalupe (a boy) gets $3 a week.

It must be borne in mind, however, that the Mexican dollar is worth considerably less than the American dollar. The premium is about 30 per cent., and seems to be rising: that is to say, an American silver dollar is worth $1.30 in Mexican money, when you come to sell it, and, of course, worth something more than that if you wish to turn Mexican money into American. It is said that the Mexican dollar contains more silver, and that of a finer quality, than the American dollar. If this be so, I suppose the difference in the value of the two pieces must be due to what the various commercial nations think on the subject of the relative stability of the respective governments.

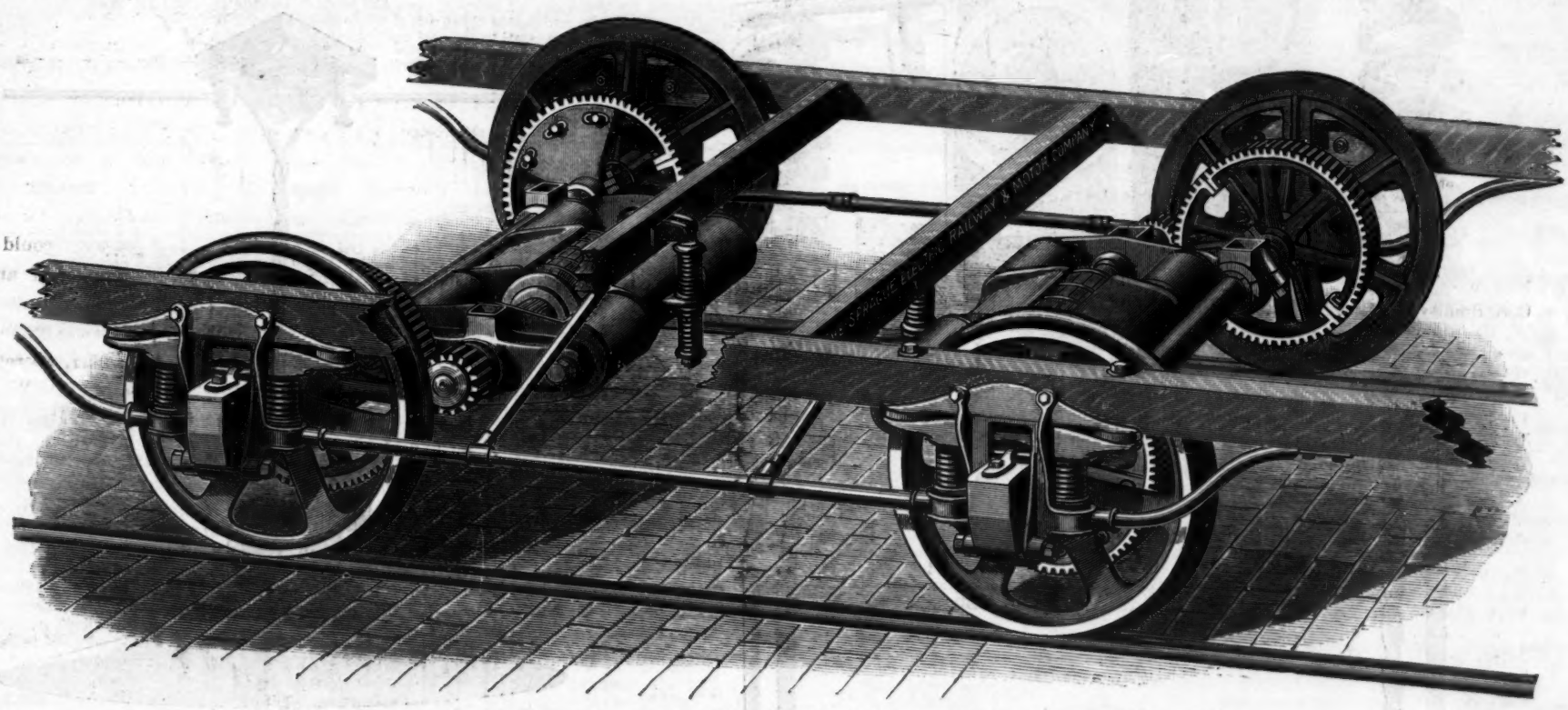
The wire used by the Mexican Telephone Company is No 14 steel. The poles, which are tall and handsome, are made of camphor wood, and last a long time. For these poles, running from 65 to 90 feet, the company pays $5 each, in addition to about $8 freight to get them to the city.

The Federal government subscribes for about forty telephones in the City of Mexico, and the city government for about ten, paying $5 a month for each instrument. Most of the supplies used by the company are furnished by the Western Electric Company.

The Mexican Telephone Company has not yet paid any dividends. Some of its stockholders have asked me since my return from Mexico what I thought the probabilities were of the company making some return to its stockholders, and I have given it as my opinion that with proper management the company ought to pay a fair dividend on a reasonable capital. One of the stockholders, referring to this subject, writes me the following, which I quote here for the benefit of any who may be interested in the matter:

"I note from the recent annual report of the Mexican Company—referred to in THE ELECTRICAL WORLD of April 23—that the receipts for 1886 are one-third less than in 1885, which doesn't show much progress. The net earnings are just about 10 cents per share on the old capital before assuming the over-issue. I heartily believe in the recommendation of President Sargent to consolidate the parent and *live* sub-companies, and it could be done with equity to all concerned by a voluntary surrender of say one-half of the present shares into the treasury, and then issue them out again in exchange for such sub-company shares as have actual property and business behind them. The Mexican Central Telephone Company has over half as many paying subscribers as the parent company, and its exchanges are in the chief growing cities of Mexico, and if its exchanges could be acquired by the Mexican Company, the expenses of one organization would be saved and a future source of good revenue added to it. The consolidation should be on the basis of paying subscribers and money expended in plant, and of the 9 original sub-companies, probably only 3 or 4 need to be recognized at all, the others having made no development of their territory. I hope Messrs. Colgate & King, the New York directors, will push for a reorganization and general overhauling of business methods. I believe that under proper management and consolidation of worthy interests, a fair percentage could be earned upon $1,000,000 of *boiled down* capital in Mexico."

As I said in a former article, time is not a valuable enough commodity in Mexico to make a very great demand for telephones. Every one seems to have plenty of leisure, and there is no particular hurry about doing anything, so that I should imagine it to be somewhat of an up-hill job to get subscribers to a telephone exchange. Notwithstanding this, however, it struck me that the telephone exchanges in the City of Mexico and the other larger cities and towns throughout the Republic ought to number more subscribers than they have.



TRUCK OF CAR FOR SPRAGUE ELECTRIC RAILWAY, RICHMOND, VA.

What Is Invention?

To the Editor of The Electrical World:

SIR: In reply to your suggestion for an acceptable definition of the word "invention," I wish, first, to quote from the interesting article of Mr. W. C. Barney, in the same number of THE ELECTRICAL WORLD, the opinion of the late Sir George Jessel.

"Though nobody knows how to make a receiving instrument, if we are told this is a telephone receiver that will give articulate sound, it would nevertheless be a publication, though nobody knows how to work it."

I wish to call attention to a part of the sentence just quoted, namely: "*this is* a telephone receiver that *will give* articulate sound." That is to say, it is not a description of a telephone receiver, but it is *the thing* itself.

The same sentiment prevails in the opinion of Com. Leggett: "When the inventor has reduced his theories to practice, a description or illustration may demonstrate its completeness."

Viewing the question as I do, my definition of the word "invention" is: An invention is a device arranged, constructed or applied to demonstrate or utilize the realization of the idea conceived in the mind.

BROOKLYN, N. Y. J. M. HUGHES.

Incandescent Lamps on Arc-Light Circuits.

The accompanying engravings show the methods employed by the Bernstein Electric Light Manufacturing Company, of Boston, for running their low resistance lamps in series and multiple series on arc circuits. Fig. 2 is a view of the cut-out for the 60 and 125 c. p. lamps, which are used in series with the arc lamps. The fixture is compact and complete in itself, embracing a hanger-board, short-circuiting switch, lamp-socket and support for the lamp-shade.

Fig. 1 represents the cut-out for connecting the 30 c. p. lamps, two in multiple, to an arc circuit. The cut-out is inserted in the main line in series with the arc lamps, and the incandescent lamps are connected to it, one on each side. We understand that these appliances are in successful operation in many places.

Sparks from Gas Pipes.

To the Editor of The Electrical World:

SIR: As a subscriber to your valuable paper, I take the liberty to ask you to explain the cause of the electric shocks as described in the following item, clipped from our morning paper:

"A gentleman living on Middle street reports that for several hours on Sunday evening last a person could not touch the gas fixtures or steam-heat radiators in his house without receiving a very perceptible shock of electricity."

I understand that in a certain drug store here the same result was observed. Will you please enlighten me as to its cause? WILBER I. TRAFTON.

PORTSMOUTH, N. H.

ANSWER.—The phenomenon observed was probably due to the fact that the atmosphere was charged to a much higher or lower potential than the earth. The gas pipes and radiators being in good contact with the earth will have the same potential as the earth, while the persons, being insulated from the earth by the carpets or dry wooden floors, will gradually be charged to the same potential as the atmosphere, and therefore discharge themselves when they touch the grounded pipes. The effect could probably be increased by connecting the outer coating of a Leyden jar with the pipes and the inner one with numerous fine points projecting into the air, which will enable it to take the potential of the air. On connecting the two coatings with a wire, sparks will be obtained. On one occasion, while one of the writers was on the top of one of the Alps during an approaching storm, this difference of potential was so great that long blue sparks three or four inches in length issued from his finger tips accompanied by a peculiar crackling noise. The observer in that case was grounded by the snow and acted as a lightning rod.—EDS. E. W.

The Question of Lightning Arresters.

To the Editor of The Electrical World:

SIR: I send you particulars of a safety arrangement to guard against lightning that I have devised for the station in my charge.

Having connected a No. 0 wire (A. W. G.) in two or three places to the water and steam pipes, thereby establishing a good ground, I led it up to the switch-board and attached (soldered) a number of flexible cables (each No. 6, A. W. G.), with plugs at the free ends. If a storm threatens, I simply plug all the negative ends of the circuit. When the machines are shut down for the day, all the plugs are thus disposed, protecting in this way the building and dynamos when no one is there, and perhaps preventing the trimmers from getting shocks while carboning the lamps. But this I do not guarantee and have never tested, on the ground that during a storm these gentlemen display a "masterly inactivity" that would dishearten the most enterprising flash from testing the value of my device in this respect. As for myself, I remember that

"The best laid plans of mice and men
Aft gang aglee,"

and I have managed, without much effort, to choke down my curiosity on this point.

The protection to dynamos and service is complete. I have had five or six severe storms to test the device, but have not had to throw off a single circuit on account of arcs forming, nor have I *known* (by bad effects) whether the electric discharge passed through the dynamos or regulators or not; in fact, I have seen the lightning jump from the positive pole to the grounded negative pole, distant about two feet, but no flashing of machines or diversion of the current in external circuit occurred.

I find that with the negative poles of eight dynamos all thoroughly grounded, I have had no trouble whatever, nor are telephones interfered with; but the lines *must* be in good shape.

There are two objections to the plan; first, accidents to lines whereby crosses or grounds are formed may cut out a lot of lamps. I had this forcibly brought to my notice by a pole being washed away. Secondly, there is danger to men starting a sticky lamp. For these reasons I prefer the arrangement of Mr. Wood, if it is efficient, and I think it is.

As to electro-mechanical devices, I think they are a snare and delusion, and only good to sell—sell everything except the lightning. They do not act until the mischief has been done, viz., the lamp circuit cut out, and there is the consequent probability that several of them do not start up when the current is turned on again on account of carbons being crossed.

A common error is made by testing these devices with a high potential dynamo. When we remember that 11,000 volts will only "jump" about ¼ inch, we can begin to understand the difference of a dynamo with, say, 3,000 volts and a lightning flash that can (probably) jump a mile and with a potential that nobody knows to within half a volt! ROBERT S. DOBBIE.

AKRON, O.

Armature Insulation.

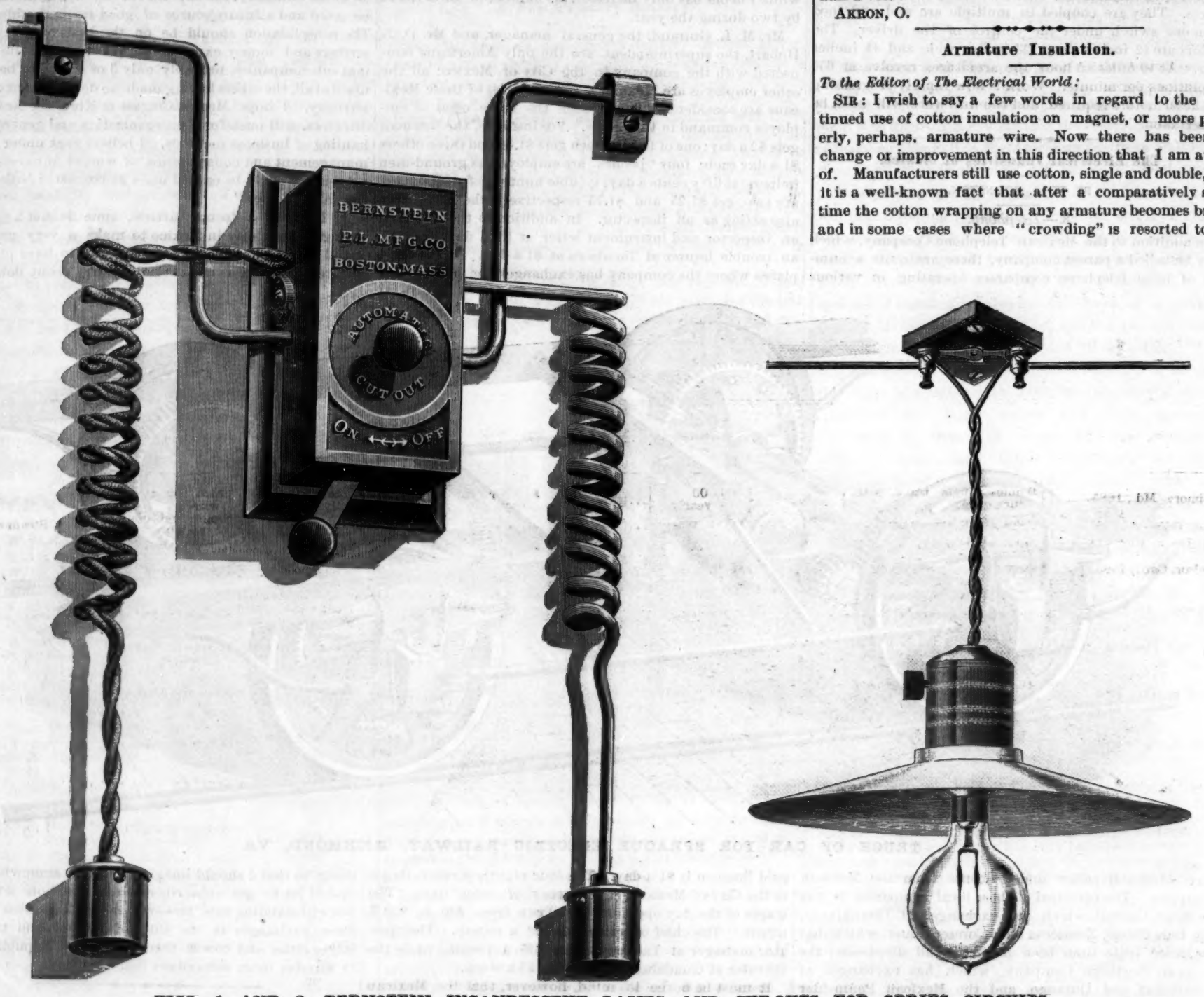
To the Editor of The Electrical World:

SIR: I wish to say a few words in regard to the continued use of cotton insulation on magnet, or more properly, perhaps, armature wire. Now there has been no change or improvement in this direction that I am aware of. Manufacturers still use cotton, single and double, and it is a well-known fact that after a comparatively short time the cotton wrapping on any armature becomes brittle and in some cases where "crowding" is resorted to, actually carbonizes. And then again, the practice is to use thick coatings of shellac varnish, which also has a tendency to deteriorate by heat and long use, and make its efficiency as an insulating binding very poor. I, at least, have found it so on a great many dynamos, and among several which have been under my charge, the armatures of which I have scratched with my finger nail and laid bare the wire.

Now, I think a great improvement in insulating wire for armatures is badly needed. A material should be sought for that would not carbonize, and a varnish better than shellac. Why would not silicate of soda be practicable? And why not use asbestos for covering the iron core instead of shellacked muslin or paper? Then again, I would suggest soft mica between the commutator segments instead of paper fibre. Some manufacturers are using mica with very gratifying results.

I believe if something like the above were carried out in the construction of armatures, cross circuits, niggers, etc., would happily be avoided, and electrical engineers would look with more complacency on their rapidly revolving and sometimes overworked armatures as they "swim" in the Polevacycle! CHAS. D. VOORHEES.

CINCINNATI, O.



FIGS. 1 AND 2.—BERNSTEIN INCANDESCENT LAMPS AND CUT-OUTS FOR SERIES CIRCUITS.

Annual Meeting of the American Institute of Electrical Engineers.

We conclude below our report of the annual and general meeting of the American Institute of Electrical Engineers, held in this city May 18 and 19.

Mr. T. C. Martin then read the following paper (accompanied by the annexed tabular statement):

A FEW COMPARATIVE STATISTICS OF ELECTRIC RAILWAYS.

It is not now my intention to present a paper on the general subject of electric railways. That I did at a meeting of the Institute held last December, when I was enabled to offer a few statistics on the electric railway as compared with horse, cable and other methods of traction for street cars. I have found since then a great desire, generally, for information as to the status of electric roads in the United States and Europe. Street railway men, inventors and others have wished to know whether such a thing as an electric road was really operating anywhere or not, and, if the lines were running, what the cost of construction and operation was. The tables I submit herewith are intended as an answer to those queries. It has been difficult to get at a common basis of estimate and statement. With regard to the European roads, I would say that I have been greatly indebted for the figures to a most admirable and exhaustive paper, read a few weeks ago by Mr. Anthony Reckenzaun before the London Society of Arts. His data were so full as to leave little necessity for supplement; in fact, I have not gone into a number of details considered by him, because I desired to keep the tables within due limits. In Europe, as here, various systems of transmitting the current and of connecting up the motor with the car axles and wheels are in use, and, as yet, no determination as to the best method seems to have been reached.

Respecting the figures for this country, I would say that they are necessarily very much in the shape of an estimate as to the number of passengers; though, by allowing each car only 50,000 passengers a year—merely 150 a day—my calculations come out as rather low. The facts may be summed up by saying that in Europe the electric railways are now carrying passengers at the rate of 3,000,000 annually. In America they are carrying at the rate of over 3,500,000, and when the roads now building are finished—to say nothing of the scores for which contracts are being made—the number carried will be up to at least 7,000,000 annually. When the roads at the place I enumerate in the tabular foot-notes all go into operation, the number will be easily quadrupled. As to cost, I would remark that in every instance yet brought to notice, electricity has spelled economy. I saw recently some authentic and extremely elaborate statistics for 1879 of street railways and their cost in New York and Brooklyn. They were not prepared to demonstrate the superiority of electricity, as the opportunity neither offered nor suggested itself. They were taken from the various official reports. The showing for the total cost of operation per car ranged between $8 and $10 per day at that time. The saving on that with electricity is, according to circumstances, at least 25 to 40 per cent. with heavy traffic. It might be said that horse roads have found new methods of cutting down expenditure since then. I cannot discover them, except in the item of horseflesh, it being the fact that dating from the great extension of the elevated steam roads in this city and Brooklyn, the lightening of the loads has given the horses one or two years more of life and service.

THE CHAIRMAN (Mr. S. F. Shelbourne): Gentlemen, this question of electric railways is one which is very full of meat and very full of promise; it is something which it seems to me will immediately develop itself extensively, and within the next two years we will have five times the number of electric railways in operation that are now in operation, and electric railways of more extensive routes.

This morning Mr. Frank L. Pope made some statements in regard to investigations which he had carried out with reference to that subject, and I at that time felt on the point of asking why he did not state the location of the proposed railway nor the battery that he had calculated upon the storage battery. I wanted to ask him whether in his calculations he took as the basis the storage battery that he had investigated, and whether he made any estimate as to the comparative percentage of cost for running a car with such a battery as compared with horse power.

Mr. FRANK L. POPE: In reply to the Chairman, I would say that I did not mention this morning the kind of battery used nor the railway that we were making tests for, simply because I did not wish it to be considered that I was doing it for advertising purposes, although there is no possible objection to making the statement. The line for which the investigations were undertaken is that of the West End Company, of Boston, and the battery of which we have completed the test is the Julien battery, and I may say that we have devoted a good deal of attention to getting at, as nearly as we can, in the absence of actual experiment on the road under working conditions, the probable comparative cost. I think it will come to about seven cents per car mile, as against ten to eleven cents per car mile for horse power; but experience may modify those figures; still I do not think they will be far from the true cost. We have gone to great trouble to get accurate data.

Mr. J. A. Powers then read the following paper on

CENTRAL STATION CONSTRUCTION.

There are two ways of constructing a central station for electric lighting, each of which has its special object. They may be defined as the speculative and the investment plans. The first has as its legitimate, or rather, illegitimate end, the sale of the plant to some unfortunate, perhaps unwilling capitalist, by fair means or foul. We may consider as fair means the not uncommon method of selling

ELECTRIC RAILWAYS IN EUROPE, APRIL, 1887.

PLACE.	Length.	Motors and motor cars.	No. of passengers.	Freight.	Total expense of operation.	Car miles run yearly.	System of conductors.	Prime power.
Lichterfelde-Berlin, 1881...	1½ miles.	2	100,000 yearly.	.....	....	....	All rail.	Steam engine.
Brighton, 1883.....	1 mile (single track).	2	1,000,000 total.	.....	1.92 pence per car mile.	46,950.	All rail.	Gas engine.
Moedling-Hinterbruehl, 1884	2.8 miles (single track and sidings).	12	340,000 yearly.	.....	3.42 pence per car mile.	91,002.	Overhead slotted tubes.	Steam engine.
Frankfort-Offenbach, 1884..	4.1 miles (double track).	14	990,000 yearly.	....	3.83 pence per car mile.	292,269.	Overhead slotted tubes.	Steam engine.
Zankerode (mine), 1882.....	790 yards (double track).	1 locom. 16 wagons.	.....	300 tons daily	.77 penny per ton.	660 wagons daily.	Overhead inverted ⊥ rail.	Steam engine.
Hohenzollern (mine), 1884...	820 yards (double track).	1 locom. 15 wagons.	.....	300 tons daily	.5 penny per ton.	600 wagons daily.	" " "	Steam engine.
Portrush, 1883.....	6 miles (single track).	4	Over 100,000 up to 1885.	.....	2½ pence per car mile.	....	Third rail.	Water power.
Besspool, 1885..... ..	3 miles (single track).	8	300,000 yearly.	30,000 tons yearly.	4 pence per train per mile.	60,000 train miles yearly	Third rail.	Water power.
Blackpool, 1884.....	2 miles (single and double).	10	Over 1,000,000 total.	.....	Less than 4 pence per car mile.	.....	Conduit.	Steam engine.
Brussels, 1887.....	.....	5	....	.....	....	.....	Operat'd by storage batteries	.....
Hamburg, 1886.....	....	2	.....	.....	.....	.....	Operat'd by storage batteries	.....

NEW ROADS.—A special charter has been granted by the Austrian Government for a road in the Austrian Alps to cost about $350,000, and to be 15 miles in length.
A road is being built in the great salt mines at Stassfurt, Germany.
The North Metropolitan Tramway Company in London has several motors now ready for use with storage batteries, on its line, awaiting powers from Parliament.

ELECTRIC RAILWAYS IN AMERICA, APRIL-MAY, 1887.

PLACE.	Length.	Motors and motor cars.	No. of passengers	Freight.	Expense of operation.	Car miles run.	System of conductors.	Prime power.
*Baltimore, Md., 1885.....	2 miles (single track with turn outs).	6.	260,000 yearly.	.....	$4 per car per day.	Each motor runs 73 miles daily.	Third rail and overhead wire.	Steam engine.
*Los Angeles, Cal., 1887....	3 miles, single and double.	8.	200,000 yearly.	.....	.....	.....	Single and double overhead wire.	Steam engine.
*Port Huron, Mich., 1885-6.	4 miles, single track.	8.	275,000 yearly.	.....	.....	....	Single overhead conductor.	Steam engine.
*Windsor, Can., 1885.....	Nearly 2 miles, single track.	.	200,000 yearly.	.....	$4 per day for power.	64 miles each car per day.	Single overhead conductor.	Steam power from electr light station.
*Highland Park, Detroit, Mich., 1886.....	3½ miles single track.	2.	200,000 yearly.	.....	80 cents per day for fuel.	Each car runs 13 hours daily; capacity, 30 passengers; speed, 15 miles an hour.	Sunken central rail.	Steam engine.
*Dix Road, Detroit, Mich., 1886.....	1¼ miles, single track.	4.	300,000 yearly.	....	.....	The trains run from 6 A. M. to 11 P. M.	Double overhead conductor.	Steam engine.
*Appleton, Wis., 1886..	4½ miles, single track and double.	8	400,000 yearly.	.....	For power, wages of one man, as they own their own water p'w'r	17 hours daily.	Double overhead wire.	Turbine water wheels.
*Scranton, Pa., 1886.....	3¼ miles, single track, four sidings.	3.	300,000 yearly.	.....	$9 per day for power, but are putting in their own engine.	Each car runs 85 miles per day.	Overhead wire.	Steam power from electric light station.
Denver, Col., 1886.....	3½ miles, single and double.	7.	500,000 yearly.	....	$1.50 per day for fuel.	....	Conduit for series system.	Steam engine.
Montgomery, Ala., 1885-86.	11 miles, single and double.	18.	This ran 2 cars one year. Have just started other cars. (1,000,000 y'ry)	.....	50 per cent. less than horse and mule traction—General Manager's report.	.....	Overhead conductor.	Steam engine.
†Kansas City	.....	.....	.....	.....	.....	.....	.....	.....
Orange, N. J., 1887.....	½ mile built.	1.	.....	.....	.....	.....	Overhead conductor.	Steam engine.
Boston, Mass. (sugar refinery), 1887.	Short track within the works.	1 locomotive 3 cars.	.....	The cars in constant use all day; the loads averaging 10 tons per trip, and each round trip averaging 5 minutes	.....	....	Overhead conductor.	Operated from the lighting dynamo.

* Extending line or increasing rolling stock. † No specific details received, line not being yet in regular operation.

NEW ROADS—Electric railways are now in course of construction, or under contract, at Pittsburgh (3 roads); Los Angeles; Binghamton, N. Y., 4½ miles, 8 motor cars; Lima, O., 3 miles, 6 cars; San Diego, Cal., 9 miles, four 40 h. p. motor cars; Ansonia, Conn., 3¼ miles (water power); New York City (for Fulton street); St. Joseph, Mo., 20 cars; Mansfield, O.; Ithaca, N. Y.; Harrisburg, Pa.; Woonsocket, R. I.; Richmond, Va., 11 miles, 40 cars.

Companies have been formed or steps taken to build and operate electric roads at Flushing, L. I. (2); Lincoln, Neb.; Brookline, Mass. (2); East Cambridge, Mass.; Newton, Mass.; Boston, Mass.; Asbury Park, N. J.; Pelham Park, N. Y.; New Brunswick, N. J.; Plainfield, N. J.; Bayonne, N. J.; Worcester, Mass.; Scranton, Pa.; Carbondale, Pa.; Philadelphia, Pa.; Reading, Pa.; Bangor, Me.; Biddeford, Me.; Westfield, Mass.; Chicopee, Mass.; Muncie, Ind.; Gratiot, Mich.; Tiffin, O.; Cincinnati, O.; Brooklyn, N. Y.; Coney Island, N. Y.; Rockaway, N. Y.; Winston, N. C.; Jacksonville, Fla.; Pensacola, Fla.; Birmingham, Ala.; Selma, Ala.; Atlanta, Ga.; Fort Smith, Ark.; Wichita, Kan.; San Francisco; San Jose, Cal.; Newton, Kan.

a small portion of the stock, perhaps just enough to pay for the apparatus, on the strength of a showy exhibition in the hands of an expert who uses all the tricks of the trade to persuade his lambs that his system will produce double the light with half the power of any other, etc.

The foul means is the border ruffian, money-or-your-life policy, which enters a territory already sufficiently well served, not for fair competition, but to make money by being bought out.

The electric light business is rapidly emerging from the border ruffian and blackmailing stage, and as we may shortly expect these methods to be relegated to their proper realm with other things dead and dishonorable, with the growth of popular knowledge of electrical matters, we will leave them and proceed to the more legitimate methods, which I hope you will all pursue. "The fool doth think he is wise, but the wise man knows himself to be a fool," said the master of all writers, and that I may be saved entering the first class in your presence I here confess to many and grievous mistakes in our own central station construction, to which this paper owes its being, for that I may hope to save some of you part of my errors is my only excuse in appearing before you.

Let us then drop speculation as a thing of the past in our business, and make our object the construction of such work as shall promise to the sober judgment of every business man among you to produce the best results in economy of labor, supplies, and power, with the least expenditure for interest, taxes, insurance and repairs.

In all manufacturing enterprises of the day, one tenddency is unmistakably felt. To succeed in any established business one must have substantial buildings, the best improved machinery, the best site for obtaining necessary supplies at their cheapest. Electric lighting to-day has risen from the slough of speculation and stands side by side with other great manufacturing enterprises in importance. Not less than sixty millions of dollars are invested in lighting plants alone, and in the entire field probably not less than double that sum. Has not the time come when the same laws of strict economy which obtain in other large enterprises should govern central station construction?

Let us then, carefully consider our problem, plan cautiously and expend liberally in the directions which indicate the best results. It is evident, however, that we cannot expend without limit, as the deepest pocket has its bottom. Where shall we draw the line? I believe we are safe in expending every dollar which is sure of saving 10 per cent. interest on its investment, provided we have it to spend. The only danger in the path seems to be the chance of such improvements as shall throw aside our present methods of producing electricity.

Let us for a moment consider the possibilities in this direction. The best dynamos will to-day in ordinary practice convert eighty to eighty-five per cent. of the power furnished them into an equivalent of electricity. Clearly there can be but small improvement here. Coal or similar fuel is the common source of power to-day, and seems likely to remain so. The best steam plants give one horse-power hour for about one and one-half pounds of coal. The actual energy stored in that pound and one-half of coal would give about seven horse-power hours if it could be converted into power without loss, or, in other words, the best steam plants of to-day have an efficiency of about 13 per cent.

Professor Houston remarked at the last convention of the National Electric Light Association that the field where lies the greatest chance for improvement was in the direction of the thermo-electricity; the conversion of heat into electricity without the intervention of power. This is most certainly so, for if a process can be discovered which will have a reasonable efficiency, say 25 per cent., electric motors must soon supersede steam engines for power. The nature of the losses connected with the conversion of heat into other forms of energy, does not, however, give much encouragement in this direction. The nature of such losses is in the diffusion of heat by conduction and radiation, which has always proved most difficult of control. If a process of simple conversion, without the attendant development of heat can be devised, the chances of a good efficiency would be much improved, but where heat exists there is radiation, and where radiation is there will be serious loss. How serious we can only judge from our experience with the steam and other heat engines. It is probable, therefore, that we are safe in investments in our expensive steam plants, at least to the extent of the life of these plants. Let us then return to our subject proper.

The first matter of importance to be decided in establishing an electric light station is its location. The necessary qualifications for location may be classed about as follows:

1. A dry soil; dampness is fatal to electrical apparatus. A gravelly soil which will easily leach away the runnings from small drips or leaks is preferable next to solid rock. If located near a river, a wide margin of safety from flood should be allowed.

2. If practicable, a location near a plentiful water supply should be chosen. Condensation of either high or low pressure engines is desirable in every way and requires a large water supply.

3. Nearness to the coal supply. If possible, locate near a navigable stream, so as to secure cheapness in handling coal and a plentiful supply of water. If not near navigable water, get a location on a railroad switch and, if possible, near the water supply. If the two conditions cannot be fulfilled, you may make your choice between them, remembering that each additional handling of coal will cost about 10 cents per ton, and extra haul about 10 cents per 1,000 feet, and, on the other hand, that condensing your engines will probably save between 15 and 25 per cent. of your coal expense. The pressing necessity for locating near the lighting field has largely passed away with the introduction of long distance systems of incandescent lighting.

Having determined on a location, the character of building to be erected must next be considered. The most important single condition essential to the success of the electric light business is continuous and reliable service to customers. The most disastrous calamity which can befall an electric lighting business, is the destruction of its central station, and the first thing necessary to prevent such a calamity is a building practically fire proof. I believe a brick building best fulfills these conditions. Let the walls be bare, make all floors double planked and supported on iron beams; use no wood ceiling, however seductive it may be in improving the appearance of your station; leave as few openings as possible through the floors; have a nearly flat roof, with fire walls projecting above, and the building will be as nearly fire-proof as it can be, and, at the same time, fulfill the other essential conditions of insulation and a reasonable expenditure of capital. Before leaving the matter of fire protection, let me strongly advocate the use of some good automatic sprinkler throughout the building, except in the dynamo room, and especially in parts of the building unoccupied during portions of the day. A stand pipe connected with your spare pump, with nozzles on each floor, a few lengths of mill hose, a cask or two, set in convenient places and kept filled with water, and a few fire pails hung near are cheaply provided, and the improvement in insurance rates will soon pay for them. At Troy the reduction of rates has paid for the entire fire outfit in the saving of one year's premiums.

Before we design our station further, let me remark that the old adage that "cleanliness is next to Godliness," would be a most wholesome motto for the electric light business. Dirt begets dirt, and with electrical apparatus it is by far the most fruitful source of short circuits, grounds, and consequently of burned armatures and disordered apparatus generally. Let us, then, so arrange our station that that most fruitful source of dirt, our boiler house, may give us as little trouble as possible. Putting the boilers in the cellar and the engines and dynamos on the floor above is probably the worst possible arrangement next to putting all in the same room, since every opening in the floor conveys a blast of hot air laden with coal-dust and ashes. The correct method is to separate boiler and engine rooms by a fire wall and make the only opening between through a room or passage through which a strong draft of air is always passing. This we effect at Troy by means of an air shaft 6 × 8 feet, which also serves as a wire tower, and in which wash sink, urinals, etc., are also constructed. The doors leading in both directions are kept shut by heavy springs and when opened the strong draft carries all dust, smells, etc., up the chimney. This shaft is carried above the roof and the wires are carried out between the louvres of the blinds. One thing do not forget. Arrange a cellar or basement under your dynamo and engine room floor about six feet deep. You will find it infinitely convenient in connecting small pipes, etc., to the under side of the floor.

Make your dynamo room not less than ten feet high for the comfort of your men, and arrange the windows to open clear up to the ceiling, as that is where the hot air will go to escape. You may also put your windows six feet above floor, and you will save annoyance from spectators, and your men will not have so much looking to do.

The boiler house should be light in construction, having an iron roof with some outside covering, such as asphalt, to prevent sweating in cold weather. The boiler front should, of course, face either on an open lot, or a street to facilitate handling boilers, and for the same reason the front of the boiler-house should be easily removable. The floor should be of concrete not less than a foot in thickness, made of the best Portland cement, mixed about 1 part cement, 3 parts sharp sand, and 3 parts stone broken to pass 1½ inch ring.

On this may be laid a floor of flags or arch brick laid on edge. No floor of cement or of ordinary brick will stand wear.

Going back to our main building, I will follow more particularly the line of work adopted at Troy. Our lot measures 50 by 130 feet, and the problem was to develop on that space a station of a maximum capacity of 500 h. p. effective.

The lot was occupied by a mere shed covering two 80 h. p. boilers located almost exactly in the middle of the lot, one 150 h. p. compound engine just beside the boiler, belted to 48 feet of jack shaft lying parallel with the length of the lot and two feet six inches above the floor, the dynamos lying each side of the shaft, the pull of the belts being nearly balanced.

The new station was laid out in a dynamo room 50 by 90 and boiler-house 40 by 50 feet, arranged for a battery of four boilers 72 inches by 17 feet, stack 13 feet square at ground and 125 feet above the grates, wire tower in corner between dynamo room and boiler-house, projecting into the latter. As laid out, the engine stood in the new dynamo room close beside the fire wall separating engine and boiler rooms, and the boilers further out in the dynamo room. It was decided to build the unoccupied end of the dynamo room, put in engine power connected with the old boiler, shift the station, abandon the old engine temporarily, build the rest of the new station over the old, put in new boilers, then connect them and and disconnect the old boilers, remove the old boilers and finish the inside of the building. The company changed hands on May 23, 1885 and on Sept. 1 the old station was shut down at midnight and the dynamos shifted to the finished part of the new building and at six the following evening the station was in full operation in its new quarters. The plant then comprised about 600 Weston incandescent lights and some twenty arc lights. The remainder of the work was merely a question of time, and the station was first operated on its new boilers on Dec. 18, 1885. At the same time about 15 miles of pole lines were constructed and some thirty miles of wire strung for a city contract of 130 lights.

The general construction of the Troy station is believed to cover the average conditions met with in central station construction, and is, therefore, particularized. In the arrangement of dynamos and engines we desire to attain the best economical results in the following items:

1st. Best average economy in coal. 2. Best average economy in transmission of power to its work. 3. Best economy of attendance. 4. Best economy of oil waste, etc. Our customers required a day service, and we had to take this into account in our selection of engines for power and in their arrangement.

These conditions were to be borne in mind in the selection of our engines and in addition the most important condition of reliability. Compound engines offered us the best coal economy with maximum load, but had the disadvantage of poor economy with light loads. Corliss engines would occupy too much room, and both required shafting and counters to speed up, and would have forced us to use the second floor for dynamos with the attending disadvantages of extra help and upright belting. We finally decided on using the best type of high speed engines, and purchased three engines of 9x14 cylinder, each belted to a jack shaft 16 feet long, and each driving four 110 light incandescent dynamos belted in pairs from opposite sides of the shaft. The lengths were arranged to be coupled by friction clutches. This arrangement gave us a very uniform rate of coal economy, though not a very high one. The arrangement of belting made the shaft friction very small. The old compound engine was set to work on its proper duty of driving a fixed load of city lights.

The relative merits of compound, Corliss or high-speed engines are well understood, and the circumstances must in every case decide the type of engine proper to be used. Where the maximum of output is required from a small space high speed becomes a necessity. Where the load is very variable a number of smaller engines will give as good coal economy as a single larger engine with less chance of a complete failure. Where the load is heavy and constant, a pair of large engines will give the best economical results and cover the possibility of a complete breakdown. The new triple expansion engines, which are rapidly replacing all others in ocean steamers on account of their wonderful coal economy, will probably displace all others in the field.

Condensing high speed engines have not met with much favor but we find at Troy that our Straight Line engines work quite as quietly under 28 inches vacuum as without, and that the coal economy is considerably improved; probably from 15 to 20 per cent. on the engines condensed, They have also the advantage of giving us much more power for cases of emergency.

As to boilers, I am strongly in favor of boilers of large size; ours measure 60 inches by 17 feet and are of Nashua "Indian head" steel 7-16 shell, ½-inch head, and have 136-3-inch tubes. The dimensions of the tubes 3-inch by 17 feet would be out of all proportions for ordinary drafts, but our stack, 125 feet above the grates, gives us ample draft and the small tubes a great evaporating surface, and consequently a better evaporation. I am afraid I shall be considered a little unsound of mind when I state that with these boilers we are able, and do, evaporate with a mixture of one part bituminous to two of yard pea and dust 8½ to 9 pounds of water per pound of coal, and with ordinary buckwheat 10 pounds of water, feed water being at 200 degrees. But such is the case, as I shall be happy to show any one visiting us; and this is not pounds of combustible, but of coal. I have always found the ashes to cost just as much per ton as the fuel part of the coal, and therefore consider that they have no place in the relation of evaporation per dollar. We keep a daily and nightly record of our evaporation by a Worthington meter, which is on the boiler feed, and let me say that the bad reputation for veracity of meters in general will not apply to our meter, as repeated tests show a nearly constant error of 2 per cent. low.

For boiler feeds provide a reliable injector in addition to feed pump, which latter should always be used in connection with a good heater. An extra feed pump may be connected as a fire pump, and should be used regularly for some such service as washing out boilers, to insure its being in good order. Attention to surface and bottom flues is of course a daily duty. As to fittings, use some one kind of valve, get a good kind, and stick to it. Price should have no place in the first choice of valves. Get a good one, with removable seats and discs, and you will save a world of trouble and a pile of money in a few years' time. Let me remark that everything we have tried on bottom blow-offs has failed except plain plugs. The failure seems to come from scale, which will stick under the gates and seats, and bend them out of shape when closed. An extra large valve in the blow-off discharge is desirable in case of a failure of a blow-off valve.

In piping of all kinds discard elbows, and use T's only. You will frequently save taking down an entire line of pipe to make some connection by so doing, and the T's are most convenient for examining and cleaning the pipes. You should also obtain all your fittings and pipe of one party to insure good fits. Threading tools will vary with different makers and a small variation will give endless trouble with leaks.

Cover all steam pipes and remember, in choosing a covering, that it is not the material which you cover with which makes the non-conductor, but the confined air spaces in the same. Get air spaces and get them so arranged that the air cannot circulate between hot and cold surfaces. Remember also that you can tell nothing by the feeling on the outside of a covering about its effectiveness. Sensations of heat and cold are intensified by the conducting capacity of the object touched. A piece of metal attached to a steam covering till hot will convince you of this. It can be no warmer than the covering but it feels so.

In touching on the electrical apparatus I feel that I am treading on delicate ground, and I shall try and step accordingly. The principal elements of ordinary wear in dynamos are: 1. Burned coils in the armature. 2. Wear of brushes. 3. Wear of commutator. 4. Wear of boxes or journals.

In regard to burned armatures I will say that judgment should be exercised in the choice of a system as to the liability of such an accident, and this being determined, choose a machine whose armature is most readily repaired. Gramme and similar ring armatures are probably the most easily repaired. Siemens armatures and all armatures with lapped coils must go back to the factory for a good job.

As to brushes, the cheapest by far, both in first cost and wear, are the single leaf split brush. Multiple leaf brushes are usually used on commutators with many segments, and there seems to be some relation between the number of segments and wear of brushes.

Commutators of many segments are less desirable than those of few. The segments can usually only be changed by putting on a new commutator and they seldom wear true. The cost of such commutators is from fifty to seventy-five dollars. The segments on commutators of fewer bars are usually arranged to be easily removed and can then be turned up and replaced.

Plain babbitted boxes or bronze bushings are about on a par for convenience in renewal. Bronze has the advantage of not being liable to melt out and cause a shut-down, and a little patience will almost always succeed in cooling them down. For belting probably nothing is better than double pasted leather belts if well made. For large belts a few rivets must be put in.

Arc lamps should be devoid of glycerine and not easily shaken out of adjustment. The lighter and smaller lamps are, the better for handling. Arrange all inside wiring of some first class high insulation wire, especially on high tension circuits.

In the Keystone station in Philadelphia I first saw oil conducted to each machine and cylinder cup in pipes. I heartily approve of this system as saving both of oil and waste.

In conclusion, I will suggest two rules to govern central station construction:

1. Expend every dollar which will return 10 per cent. on its investment in addition to maintaining itself, including, of course, interest, taxes, insurance and wear and tear.

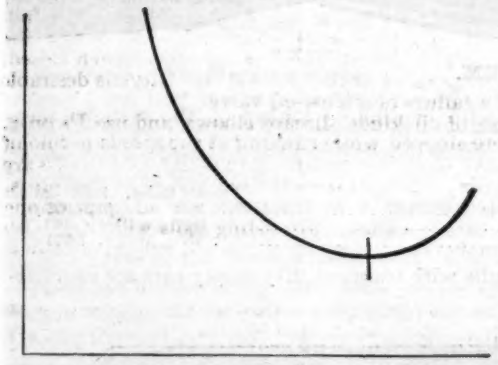
2. After carefully investigating, estimating and planning

cut the capacity of your station, make a large guess as to what you require and multiply by two.

Prof. W. A. Anthony then made an address as follows:

ON THE CHANGE FROM NEGATIVE TO POSITIVE OF THE TEMPERATURE COEFFICIENTS OF SOME CARBON FILAMENTS.

We have been at work for some time upon this matter, and I will simply state a few facts that have been reached: We found at first in the testing of a dozen incandescent lamps for the purpose of determining their efficiency with paper carbons and filaments—we were simply making measurements for the purpose of determining the ordinary electrical efficiency of the lamps—that the curve representing the relation between potential and resistance ran like this (see accompanying figure), the potential being represented by the abscissæ and the resistance by the ordinates. Now, it had been my experience that the resistance of incandescent lamps or carbon filaments ran down when the potential ran up, and this was the first instance in which I had found an increase of resistance as the potential went on, as the current increased and of course as the illuminating power increased. In these particular lamps, this change occurred very low in the temperature of the lamp. It occurred when the lamp, in fact, was only just barely red hot, and the resistance went on up to the limit to which the lamps were carried. Afterward we thought this was of sufficient interest to pursue it in regard to other lamps. We have tested a number of lamps, and we have found in some four or five different cases the same general result. Sometimes the curve changes not until we have reached the normal candle-power of the lamp, and in many lamps we have tried we never have reached any such change, the curve going on downward as far as the lamp could be carried, and, in fact, until the carbon began to disintegrate. If we, then, go back, lowering the potential point by point, the two curves will not coincide. We have found in some cases that the curve went down like this (illustrating), and turned up like that (illustrating) at the lower end; but when we went back we found our resistance was permanently increased on account of change in the character of carbon. But it is certain that in a number of different carbon filaments there is this change of resistance, and in all the carbon filaments that we have tried, except one or two, there is a change that indicates that at some point the curve runs like that shown, that at some point there would be a rise if we could carry the temperatnre far enough. Now, what I hoped to be able to present to this meeting was



LAMP TEMPERATURE CO-EFFICIENT.

the determination of something about the character of the carbon filaments which showed the change early in the temperature of the lamp, where that change began at very low temperature, to determine the difference in the character of the carbon filaments at this point; of the filaments which showed this change and of those which did not show it, and those which show a continuous fall of potential. That I have not been able to do; and furthermore, it was a point to determine the actual temperatures of the carbon. Those we have obtained with some degree of satisfaction, but I do not feel that our results are sufficiently trustworthy to present them. (Applause.)

Professor THOMSON: The observation of Professor Anthony is quite interesting to me, because one of our men reported two or three weeks ago the same phenomenon as noticed in lamps—that is, that at a certain brilliancy the resistance came to be constant and then began to rise as the brilliancy was increased. I told him at the time to pursue that a little further and let us have some better figures. He reported, too, that all lamps did not appear to do it to the same extent. There is another curious fact that was noticed and that has been reported to me in regard to the resistance of incandescent lamps. We are building lamps that are run in series on arc light circuits, using $6\frac{5}{10}$ to 10 ampères, and they are put in with the arcs and give a candle power of 32, 65 and 125. We find that when those lamps are run for a certain time, during the early part of the run—for perhaps 200 or 300 hours of the run—the resistance steadily falls. After that, it seems to steadily rise, or in other words, this effect comes in as a sort of an effect of time as well as simple brilliancy. The lamps fall in the volts necessary to carry the normal current through them. It does not amount to a large percentage, but it continues during a large fraction of the life of the lamp, and after that point the resistance begins to gradually rise. Not only has that fact been noticed in regard to the lamps of large candle power and comparatively heavy filaments of low resistance, but it has been noticed that in lamps that have been run on arc light circuits in multiple groups, the same fall and gradual increase seems to take place, and it led us to imagine that there might be some connection between the arc light current itself giving this effect. We have not noticed the same effects on multiple arc circuits, and we have not examined very thoroughly into the matter; but we have no reason to suspect, at least now, that this fall and gradual increase occurs on multiple arc circuits, but it seems to occur oftentimes, not always, in lamps that are put on arc light circuits, either in groups or in series, taking the whole current. (Applause.)

The following paper, by Mr. David Brooks, was then presented, on

LEAD-INCASED CONDUCTORS.

The first attempt in this country to work electric telegraphy by Prof. Morse, was to cover the wires with cotton, soak them in a preparation of shellac, draw them into lead tubes, four together, and the intervening space was left empty.

This system was laid from Baltimore toward Washington, about five miles on the Baltimore and Ohio Railroad. I got this information from Tatham & Bros., who made most of the lead pipe, although none of what they made was laid.

The experiment was a failure. About that time, or a little before, Professor Jacoby, of St. Petersburgh, undertook to lay cotton-covered copper conductors in lead pipe and the intervening space filled with rosin. There have been very many attempts of that kind which proved to be failures, until the year 1856, when the discovery of petroleum brought paraffine into the market as a cheap commercial product. This was brought to my notice, and I made many experiments to test its insulating properties, and as the result, it was taken to the patent office, and the patent awarded me, broadly, for its insulating properties.

It occurred to me that cotton covered wires could be drawn into lead pipe and a useful system for underground purposes accomplished, but before rushing to the patent office, specimens were buried in the yard of my factory directly under a body of water, or earth soaked with water from a hydrant. These experiments were repeated, and for a long time were attended with failure. In the journal of the *Society of Telegraph Engineers*, published in London, we find accounts of similar experiments made there with like results.

Sealing the ends of a portion of this leaded cable, coiling it up, immersing it in melted paraffine, and raising the heat to about the boiling point of water, we noticed bubbles coming out apparently from the lead. Continuing this heat until all bubbles ceased to rise and then testing the cable, we found the insulation restored. The inference was brought to my mind that the coiling and the uncoiling of lead produced such molecular changes in the metal as to make it sufficiently porous to admit moisture, and the many unsuccessful attempts to lay lead-covered cables, when the cables were insulated with paraffine, in deep water have served to strengthen this impression

It must be borne in mind that paraffine, rosin, asphalt and other similar substances in their normal condition are brittle and the coiling and uncoiling of the lead pipe breaks them into innumerable small particles, which would leave the cable full of cracks or crevices.

These circumstances suggested the use of oil, and that brought out my system of iron tubes on account of their cheapness.

Lead-covered cables are now successfully made by having the insulating material either rosin, asphalt or pitch, mixed with oil in sufficient quantity to make the material plastic and capable of being bent without fracture.

Some of the inventors of these mixtures have repeatedly stated that their insulating material is a secret. Other materials are the subjects of patents.

Asphalt, rosin, or pitch, when mixed with oil sufficient to make them plastic and not to crack, is heavier than water, and thereby a great advantage is gained. Paraffine, either solid or liquid, is lighter than water. If solid, it cracks; if liquid, a drop of water penetrates it by reason of greater specific gravity of water.

In pursuance of the foregoing remarks we must now look at the advantage of lead-covered conductors for all kinds of indoor purposes, or what are commonly called distributing purposes for electric lighting, etc.

An ordinary cotton-covered paraffine conductor for inside work is a dangerous thing. There has been sufficient property destroyed by the use of these cheap articles to pay fivefold the substitution for them of lead-covered conductors.

A lead-covered conductor, No. 18 gauge, will show an insulation resistance of 10,000 megohms per mile. When used for inside telephone purposes, if the lead covering is attached to a gas or water pipe, there is perfect safety from fire from the electric current, should the outside conductor come into contact with an arc light conductor.

A copper conductor, No. 00, for arc lighting can easily be insulated when lead incased to 500 megohms per mile, and when that is brought into a building for distribution purposes, and the lead covering connected with a water or gas pipe, there is perfect safety from fire from the electric current, such as occurred at the Temple Theatre in Philadelphia. Again, we can scarcely see how persons could be injured by the electric current conveyed through an insulated conductor covered with lead pipe, as was one of the employés of the Brush Company in this city, who was killed not two weeks ago, and since then, as another person was killed in the Adams Express building in New York.

Mr. J. N. Millar, of Cincinnati, has referred to several instances where people have been killed by taking hold of the electric light conductor covered with what is known as the underwriters' insulation, which is simply no insulation at all when exposed to dampness. As this insulation cannot be made to burn with a lighted match, it has been supposed to possess great elements of safety. But when it is encased in lead, and used for incandescent or arc lighting, a great portion of the current passes through the "insulation" to the lead covering.

Taking a piece of this underwriters' wire, covered with lead, and testing the insulation from conductor to covering with a current from a Holtz machine, you can produce no disruptive discharge, because the current passes through the "insulation" quickly, as fast as you can generate it by the machine. Take a similarly constructed lead-incased cable, properly insulated, immerse both ends of it in the insulating mixture and pass a current from the Holtz machine through naked conductors through the air, one pole connecting with the incased conductor and the other with the lead covering; a spark two inches long will pass between the two conductors in the air before any passes between the casing and the conductor, although the distance through the insulation is only one-eighth of an inch. The object of immersing both ends of the incased cable in the insulating material is to prevent short circuiting through the air from copper conductor to lead covering at the terminals. (See Fig. 1.)

Much has been said of the incombustibility of the underwriters' insulation. But it is no more incombustible than the proper insulation, provided the spark is not exposed to the air. We can make a disruptive discharge through the insulation if it be too thin, but no combustion takes place, because the air is excluded.

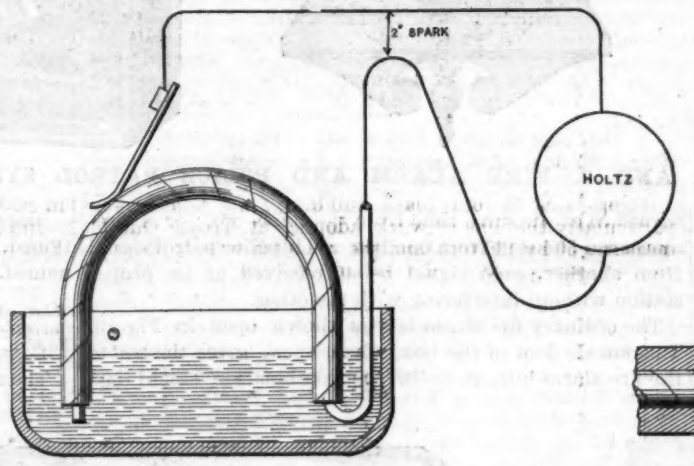
We can now compare this insulation with gutta-percha, caoutchouc, and their compounds.

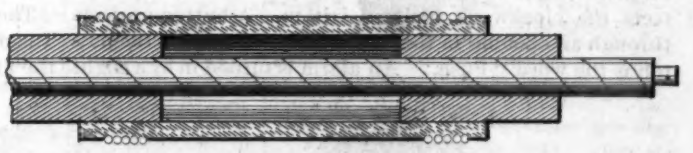
Exposed to the air, a lead covered conductor will last ten times as long. Besides this, when running these seam-covered conductors around right angled corners, the insulating covering is apt to open upon the outside of the bend, while a lead-covered conductor will bear much rougher usage.

This quality has been demonstrated by a lead covered cable for telephone and telegraph, armored with iron wire, and laid across the bottom of the river Delaware between Philadelphia and Camden seven years ago, where it has worked without interruption or deterioration for all that time, although occasionally hooked up by anchors and doubled upon itself.

Other cables laid in the same locality have had frequent interruptions; some have been entirely destroyed and replaced by similar ones, which have perished in their turn, and, for aught I know, the process is still going on. However, there is another class of electricians coming upon the stage who do a little of their own thinking, and they have found out that there is both economy and good service attained by more recent devices.

There has been one objection to these lead-incased conductors, that the space *at the terminals* between the casing and the conductor is so short that when exposed to a damp atmosphere moisture collects upon the surface of the unprotected insulating material, and thus the insulation of the conductor is impaired. Messrs. Tatham & Bros. have a simple device by which that difficulty is completely remedied. A short section of the lead casing is cut out





FIGS. 1 AND 2.—LEAD INCASED CABLES.

some inches from the terminal and an India-rubber sleeve slipped over the gap, and over both parts of the lead pipe remaining. Both ends of the sleeve are then tightly bound to the lead pipe with twine, and the insulation of the cable is safe from moisture. (See Fig. 2)

The PRESIDENT: Is there any other business before the meeting?

Mr. R. W. POPE: I have two resolutions that I would like to offer:

Resolved, That the sincere and heartfelt thanks of the American Institute of Electrical Engineers be, and are hereby extended, to the American Society of Civil Engineers and its able and hospitable secretary, Mr. John Bogart, and his assistants, for their continued favors and courtesy tendered to us, beginning with the organization of this society and continued during its progress toward its final establishment upon a firm and enduring basis.

Resolved, That whereas imitation is the sincerest form of approbation, that we pledge our efforts to exercise our means and energies to the immediate establishment of a home of our own, to which we hope hereafter to extend our hospitality to all engineers of every branch who may desire to avail themselves of the information developed, as the introduction of electric industries grows in public importance.

The resolution was adopted.

Mr. R. W. POPE: I also beg leave to offer the following resolution:

Resolved, That the members and associates of the American Institute of Electrical Engineers, as a slight appreciation of the courtesies extended to us by Mr. Erastus Wiman, president of the Telemeter Company, and Mr. C. C. Martin, chief engineer of the East River Bridge, do hereby extend their hearty thanks for the thoughtfulness and hospitality of those gentlemen in providing for a most enjoyable scientific and social entertainment in connection with their annual meeting.

The resolution was adopted.

Mr. MAILLOUX: I would like to call attention to the fact that no action has been taken yet to perpetuate the arrangement in vogue last year for monthly meetings.

The PRESIDENT: It is within the discretion of the Council.

Mr. MAILLOUX: It was intended to have some amendment to the constitution at this meeting, was it not?

The PRESIDENT: It was found that no action was necessary. I think we have all had a day of great pleasure and profit, and we shall go to our regular daily duties refreshed and benefited and better able to do the work that lies before us. There being no further business a motion to adjourn is in order.

On motion the meeting then adjourned.

Fire Alarm and Police Patrol Telegraph System.

The question of insurance rates is so intimately connected with the facilities for extinguishing fires that not only private concerns but cities find it to their interest to afford the best possible protection to inhabitants. The rapid notification of the fire department of the breaking out of a fire is acknowledged to be one of the principal safeguards, and hence fire telegraphs are rapidly extending in use. Among the systems recently brought out for this purpose, and which also includes a police telegraph system, is that of the Richmond Fire Alarm Co., of Richmond, Ind.

Our illustration, Fig. 1, represents the combination fire alarm and police patrol box with the front door closed and the police or side door open, showing the key for signaling purposes and the lower end of the lever for releasing the police key; there is also a police key in lock above the door for the purpose of calling the police or patrol. The police key cannot be removed by a citizen sending in a police call, but it is released by the police or patrol upon their arrival, they only having the keys to the lower door, giving them access to the releasing lever.

Upon opening the front door of the box to turn in an alarm of fire, a second door is found, which securely protects the clockwork inclosed within. A button projects through an opening in the inside door, and above the button is the word "Push." An alarm is turned in by a slight pressure on the button, which sets in motion the clockwork of the box, the mechanism of which opens and closes the circuit a definite number of times. Each time the circuit is opened a stroke on all the gongs in the circuit is given, the number of strokes corresponding to that of the signal box.

The mechanism of the combination box is shown in Fig. 2. The clockwork is inclosed in an iron box, with glass front. Inside of this box is the circuit breaker, which is inclosed in a round hard rubber case with a glass front, air-tight and dust-proof. The circuit wheel is of hard rubber and the contact points are of platinum. Below the clockwork is the tap bell with telegraph keys. The key on the left is for the use of the chief of fire department for private signals between the box and the engine houses and water-works, and also for testing purposes. The bell magnet is to receive audible signals sent from the engine houses, and also to notify persons turning in an alarm that signals are being transmitted.

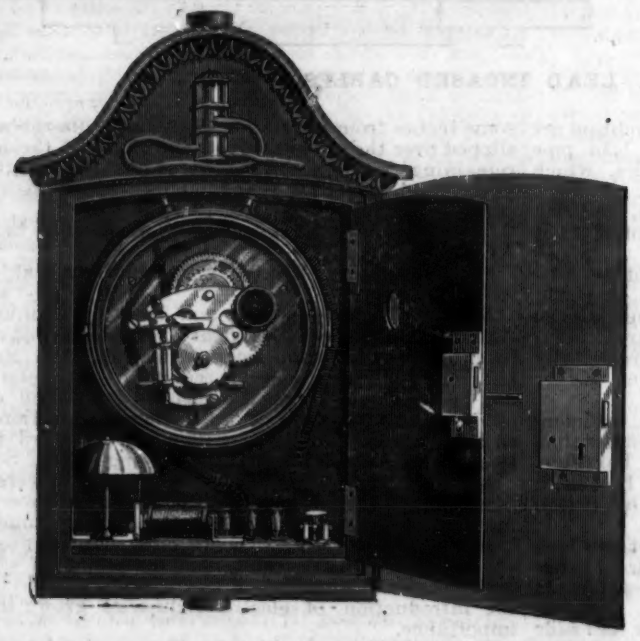
The key on the right projects back of the iron partition, and is for the use of the police, after a patrol signal has been sent, to convey additional information, so that in case of an accident a surgeon may accompany the patrol wagon; or should more than the usual number of police be required, as in case of a riot or other disturbance, the fact may be instantly communicated to headquarters. Both the fire alarm and the police patrol signals may be turned in at the same time from the same box; or a fire-alarm may be sent from one box and a police patrol signal from another, each signal being received at its proper station without interfering with the other.

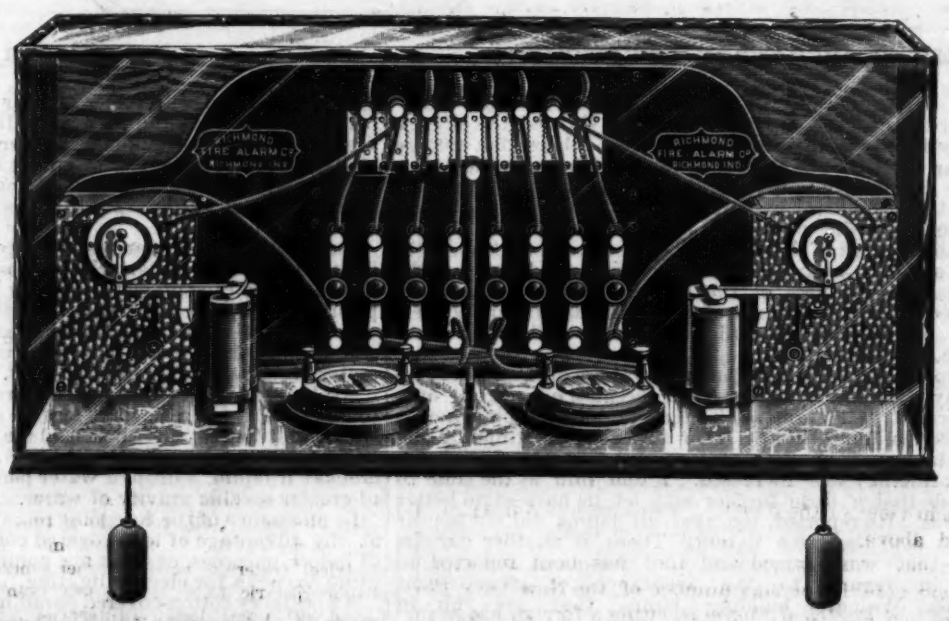
The ordinary fire-alarm box is shown open in Fig. 3. The outside door of the box, when open, gives access to the fire-alarm button, as in the combination signal box already described. The clockwork and circuit-controller are also similar to those in that box.

The instrument represented in Fig. 4 consists of a self-inking receiver, combined with an electro-mechanical spring gong for engine, hose and water-works pump houses, each with its own magnet, and acting entirely independent of each other, so that if the gong should accidentally miss a blow the register will not fail to make the right record.

For repeating the signals coming in on one circuit into the others, the automatic repeater shown in Fig. 5 has been designed. This apparatus has been reduced to the simplest possible form, and is hence little liable to get out of order.

FIGS. 1, 4 AND 2.—FIRE ALARM AND POLICE PATROL SYSTEM.





FIGS. 3 AND 5.—FIRE ALARM AND POLICE PATROL SYSTEM.

"Enode."

To the Editor of The Electrical World:

SIR: Allow me to suggest, for the unnamed space in the dynamo, the name, "Enode," from the Greek *ἐν*, in, and *ὁδόν*, passage.

C. M. BROOMALL.

Electric Brake Tests.

A series of tests of brakes for freight trains has just been virtually closed at Burlington, Ia. While a general improvement in the means of controlling the speed of long and heavy freight trains has been shown, the most remarkable point developed has been the general adoption of electricity to secure greater promptness of action of the valves of air brakes, and a better graduation of the power applied, and the apparatus showing the best results in the trial was entirely manipulated by electricity. There were but three systems thoroughly tested; others were withdrawn through mechanical or electrical defects, and still others expected to be applied to trial trains were not exhibited. The tests were conducted on a section of track several miles long, with varying grades and curves, and consisted of emergency stops at various speeds, and break-away stops such as would be made if the train parted. The following table shows the distances in feet at which trains of thirty three loaded and seventeen empty cars, equipped with continuous brakes of the systems mentioned, were stopped while running at the speeds per hour named.

	Twenty miles.	Forty miles.
Westinghouse	202	927
Carpenter	247	1,365
Eames	468	1,651

The results with trains of fifty empty cars are summarized as follows: Stops are in feet, speed in miles per hour, and no allowance made for grades or other minor disturbing influences:

	Electric.		Air or vacuum.		Driver and hand.	
Speed	20	40	20	40	20	40
Carpenter	124	5 7	....		....	....
Westinghouse	155	578	239	732	....	....
Eames	291	690	342	1,036	....	....
Card	432	1,628	....	....	....	....
Hasscom	....	....	933	3,900	....	....
Armstrong	....	....	....	....	939	3,473

Low Resistance Incandescent Lamps.

To the Editor of The Electrical World:

SIR: Will you kindly inform me in your valuable journal if there is manufactured in the United States any low resistance incandescent lamp for use on arc circuit, and, if so, where are they to be bought? READER.

NEW YORK.

ANSWER.—There are various firms among our advertisers who can probably supply your wants. We described such a lamp a short while ago.—EDS. E. W.

The Problem in Resistance.

BY R. S. WHITE.

In THE ELECTRICAL WORLD of May 7 appeared an article under the heading, "Another Problem in Resistance.' Kindly permit me to offer the following solution :

Two cells connected in multiple arc are discharged through a common resistance.

First. To find the value of the common resistance when the current in the weaker cell is zero.

As is suggested, let E and E' be the two E. M. F.'s, R and R' the internal resistances; C and C' the two currents in the two cells respectively, W the external resistance, and A the current in the external circuit.

In addition, let V represent the voltage at the connected terminals of the cells. The connecting wires are supposed to be of zero resistance.

Assume A to be equal to the algebraic sum of C and C'.

By Ohm's law

$$A = \frac{V}{W}; \; C = \frac{E-V}{R}; \; C' = \frac{E'-V}{R'}.$$

Let C' represent the current of the weaker cell.

By assumption $A = C + C'$.

By condition $C' = 0$.

Substituting, $\frac{V}{W} = \frac{E-V}{R} \therefore W = \frac{VR}{E-V}$.

Second. To find the current which will flow in the external circuit as well as in each cell in a common short circuit.

Assumption $A = C + C'$.

Condition $V = 0$.

But $C = \frac{E-V}{R} = \frac{E}{R}$;

and $C' = \frac{E'-V}{R'} = \frac{E'}{R'}$. $\therefore \; A = \frac{E}{R} + \frac{E'}{R'}$.

Third. To find the current circulating through the cells when the external circuit is infinite:

Assumption $A = C + C'$,

Condition $A = 0$. $\therefore \; C = -C'$.

Calling E' the E.M.F. of the weaker cell, the resultant E.M.F. evidently equals $E - E'$;

and obviously $C = \frac{E-E'}{R+R'}$,

LABORATORY EDISON CO., BOSTON, MASS.

Wheatstone and the Word "Telephone."

To the Editor of The Electrical World :

SIR : I see that you have honored my historical paper upon the origin of the word "telephone" written for your monthly contemporary, with an editorial notice, appearing in your issue of May 7, 1887.

Referring to the statement of a correspondent of the *London Electrician*, who draws attention to an extract from "Lives of the Electricians," said to be written by Wheatstone himself in 1840, and using the phrase, "*establishing telegraphic (or rather telephonic) communication*," I desire to point out that the said correspondent cannot have read my communication, and has, evidently, acquired his information merely from an abstract appearing in a former number of the said *London Electrician*.

A glance at my original article will show that I did not state, as you intimate I did, that "the term did not appear to have suggested itself to Wheatstone." What I did say, after referring to *all* the papers written by Wheatstone at the time of his early experiments, was the following : "I have been somewhat disappointed to find that *in these papers* Wheatstone himself does not employ the word telephone, although there is reason to believe that he was in the habit of referring to his appliances for transmitting sound by that name."

I was quite aware that Wheatstone used the word *telephonic* in the letter referred to by the *Electrician* correspondent ; but *telephonic* is not *telephone*, and, moreover, there is no date appended to the communication, although the said correspondent says it was written in 1840.

But in view of the doubt. I think what I did write, as copied above, is a very proper and justly conservative statement. And in view of my subsequent and supplementary note in the May number of the New York *Electrician and Electrical Engineer*, citing a foreign use of the word, I think there is little left to be said. In my original article I also referred to Wheatstone's adoption of the word *microphone*.

T. D. LOCKWOOD.

BOSTON, Mass.

Series Railway Priority.

To the Editor of The Electrical World :

SIR : I regret exceedingly that my plain statement in regard to the priority of the invention of the series system of electrical railways should have called forth such a strange reply from Mr. Cecil P. Pool, who jumps into the arena like an electrical Bunthorne, and shouts out "boo." This is indeed an irrefutable argument! I, too, regret that his "clumsy phraseology" has made me misunderstand his claims; but it is only natural that one should interpret statements according to their apparent meaning. We can only tell what he says, not what he means, and Mr. Pool's letter, published on the 30th of April, clearly appears to indicate that he considered himself the original inventor of the "chestnut," as he calls it, in dispute, for he opens his letter with an apology for making such a claim. It was only to assert my position as prior inventor that I was induced to use your columns, and it is perfectly immaterial whether or not Mr. Pool claims to be the original inventor. Until I am informed of a priority in some one else, I surely am justified in claiming that position.

Unwilling to enter into any controversy, I make this statement merely to explain my reason for setting up a date prior to that of Mr. Pool, and in so doing I cannot see that I have erred.

R. M. HUNTER, M. E.

PHILADELPHIA, May 21, 1887.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, May 31, 1887.

Trade in and around New York continues active. Electric light contracts are being made much later in the season than usual, and the demand for supplies for telegraph, telephone and other work keeps up in a most encouraging manner.

The Union Fire Alarm Company, 145 Broadway, has just completed its contract for the electric fire alarm at Kent, Ohio, and has turned it over to the authorities. Mr. Murray is the electrician of this company, and Mr. W. A. Donnington secretary and general manager. Mr. Charles Wann, an electrician very well known to the trade and fraternity generally, is representing this excellent system out of town and introducing it into some places that have hitherto been unable to avail themselves of the fire-alarm system on account of high cost and other points. Kent, Ohio, is one of these. It is a lively and industrious town, and the residents have received their new fire alarm service with the heartiest approval.

The Standard Paint Company, of 59 Maiden Lane, received recently a letter from the manager of the Coquimbite Battery Company, Baltimore, which has been using the products of the concern in various ways for electrical work. One or two points brought out are quite interesting. He says: "We use the P. and B. paint on the brass rods in our batteries to prevent the acid from eating the rod ; and also to prevent local action in our open circuit cells. We simply dip the rods in the paint and then let them dry. For insulating cotton-covered wire we find it very good." The manager adds also, "I used it in California for that purpose, simply covering the copper and iron wire with two coats of paint, and I found it equal to the best wire I could buy in the market. I found it equal also to all necessities in painting the inside of wooden battery cells, with good results." This is evidently a strong commendation.

The McMahon-Flynn case is still dragging along, one of the last important witnesses to be examined being Mr. Alfred Sully, who testified as to his negotiations with both of the gentlemen above named, and as to the manner in which he went on the bond of the Construction Company.

The Callender Company is busy putting in cables, etc., for the torpedo station at Newport, R. I.; also upon the Edison extensions at Brockton and Detroit. At a time when we hear so much about Queen Kapiolani it is well to note also that the King of the Sandwich Islands has been supplied with a large quantity of Callender cable for his palace at Honolulu.

Mr. W. I. Wark, who is now traveling through the West for the Empire City Electric Company, reports trade good generally, and is, I learn, having an enormous run on the company's "Excelsior" bells. It is amazing what a capacity for electric bells this big continent of ours has. When will it ever be filled up?

A suit has just been commenced in the United States Circuit Court, through their solicitor, Richard N. Dyer, by Bergmann & Co., as the exclusive licensees, and Luther Stieringer and others, as the holders of the legal title, against the well-known house of Mitchell, Vance & Co., for the infringement of the Stieringer patent, No. 294,697, granted March 4, 1884, on combination fixtures. In the suit commenced some time ago between the same parties for infringement on the Stieringer patent No. 259,235, covering the insulating joint and other features of electroliers, the complainants have now taken their testimony to show the infringement.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, May 31, 1887.

Mr. A. W. Hart has been appointed superintendent of the Milford, Mass., Electric Light and Power Company.

Mr. Homer J. Goff, for a long time identified with electric light interests at the "Hub," and more familiarly known to the electrical fraternity as the former general manager of the Merchants' Electric Light and Power Company, is soon to be connected with a new electrical enterprise in Boston.

The long contested and much agitated question of giving authority to the gas companies of Massachusetts to furnish electric lights may be considered practically settled. The bill to that effect recently passed the Bay State House of Representatives, and its supporters in the Senate are in the majority.

Among the new corporations chartered by the Connecticut General Assembly recently are the following : The Hartford Light and Power Company, capital $100,000, with authority to furnish electric light and power, and The Schuyler Electric Manufacturing Company, common stock $150,000 to $500,000, and preferred stock not to exceed $350,000. As heretofore stated in these columns, the latter-named company succeeds the Schuyler Electric Light Company.

Among the new local electric light companies recently incorporated are the following : The United Electric Light Company, Springfield, Mass.; capital stock, $100,000 ; Gideon Wells and others, incorporators. The Millbury, Mass., Electric Company; capital stock, $10,000 ; C. D. Morse and others, incorporators.

The Woonsocket (Mass.) Electric Machine and Power Company is reported to be attending to all the arc and incandescent electric lighting and all the transmission of power by electric motor in that thrifty little city. The company are to furnish power for the electric street railway, now in course of construction. At a recent meeting of the directors it was decided to increase the capital stock from $50,000 to $100,000.

The reader will recall to mind the illustrated article of the Loomis system which appeared in a recent number of THE ELECTRICAL WORLD. This system of electric lighting, although new in the field, seems to be gaining rapidly in popularity. The officers of the Loomis Electric Manufacturing Company report the following contracts in hand for installation of their incandescent system, viz.: Warner, Deforest & Company, Amsterdam, New York ; Geo. Crawshaw's Sons, Newburgh, N. Y.; Clinton Woolen Company, Clinton, Mich.; and for the large knit-goods manufactory of Robert McKinnon, Little Falls, N. Y. The company also reports having just completed a plant in the Camden Woolen Mill, Camden, N. J.

Mr. Darius Houghton, of Skowhegan, Me., is complimented very highly by the Lewiston (Me.) *Journal*, which paper refers to him editorially as "a genius," owing to his having perfected a new arc lamp. The following extract from the paper named is quite interesting : "His lamp is only fifteen inches tall from the bottom of the globe. A Skowhegan syndicate owns the light, and they are confident there are millions in it. One New York man made an offer of $50,000 for a one-third interest a short time ago —so it is said—but his offer was refused. The inventor has spent a large amount of money, and considerable time, developing this scheme, and the men who own it think they have got the biggest electric light in the country."

The New England Wiring and Construction Company is in receipt of complimentary letters and words of praise for the creditable piece of work it did upon its contract for the Sprague Motor Company on the electric railway in East Boston.

By an order recently issued by the court at Hartford, Conn., the works of the Hartford Engineering Company are to be sold for $75,000, which offer was made by Messrs. Beach & Company, the well-known boiler makers of the same city.

The Taunton Copper Manufacturing Company will begin at once, it is alleged, the construction of a building adjoining its already extensive factory. The business of the company is said to be in most satisfactory and prosperous condition. It recently declared a dividend of six per cent.

Messrs. Blodgett Brothers & Company, of Boston report their firm being in receipt of large orders for their special make of hotel, house and club annunciators.

Mr. Leopold Schlegelmilch, of the Schaefer Electric Manufacturing Company, has just fitted up his restaurant on Water street, Boston, with a complete incandescent lighting outfit, which adds to the attractiveness—to say nothing of the improvement in illumination—of the place. It is almost unnecessary to state that the Schaefer system is used.

Messrs. M. M. M. Slattery and F. A. Swan deserve much praise for the work they did within a few days past of decorating the offices of the Boston Electric Light Company with groups of incandescent lamps with shades having a variety of shapes and colors. In the directors' room the most attractive of the decorations meets the eyes of the visitor as he enters. From the centre of the ceiling of the sumptuously furnished office hangs suspended a magnificent chandelier, with its numerous many colored incandescent lamps ; but more artistic and beautiful are the decorations over the mantel. A large heavy-gilded mirror hangs against the west wall, and on the mantel is a large vase filled to overflowing with artifical flowers and leaves. Thickly interspersed therein are "baby incandescents." Surrounding and overhanging the mirror are artificial climbing vines, between every other leaf being a small incandescent. As all are reflected from the mirror, they produce a doubly attractive effect.

Ex-Superintendent Parker and the engineers of the New England Telephone Company yesterday unearthed and examined the section of artificial stone laid last fall on Tremont street for carrying electric wires underground. The examination was to determine what effect, if any, the wet and freezing weather of the past winter had had on the material. The conduit was found in perfect condition. To determine if the frost had disturbed the joints a jointed rattan 185 feet long was run through the conduit, and a section of two-inch cable was then pulled through without meeting any obstruction. The engineer of the telephone company expressed himself as perfectly satisfied with the test, and in his opinion the artificial stone has more durability than anything yet tested.

Relative to certain rumors which have of late been current on the street concerning changes contemplated in the business arrangements of the American Electric Manufacturing Company in the New England territory, Mr. Elder, in conversation with the writer a few evenings since, said that while it was true a change was to be made, he preferred for the present to say nothing relative to the matter ; that at an early date the readers of the WORLD would be given the particulars.

The electrical car which has been under construction for the past two months at the car-house of the Cambridge Railroad Company was tested on the evening of May 24, in the presence of several gentlemen connected with the road, the electric light company and the press. The car is fitted with a Julien storage battery of 104 cells. A part of the current is used for the motor, which has a normal capacity of five horse-power, and a part for lighting the car, which is furnished with five incandescent lamps. Electric bells, for starting and stopping the cars, are also connected with the battery and operated with push buttons on the front and rear and at several points in the interior. The maximum speed of the car with its present battery, as described, is ten miles an hour. The car is adapted to be operated and reversed by a shifting lever at both ends. The motor is furnished by the New England Weston Electric Light Company, and the current is supplied by the Cambridge Electric Light Company, through a wire running to the car-house from the arc street system. The charge in the battery that night had been in use for two weeks. The experiments were confined exclusively to within the car-house, over a fifty-foot section of track, and were quite successful. Work will be continued upon the car with a view to demonstrating beyond a doubt the feasibility and practicability of the invention, and of preparing the car for a public exhibition.

The report comes from Portland, Me., that a new corporation was recently organized in that city under the name of The Beattie Battery Zinc & Electrical Company, for the purpose of manfacturing and dealing in battery zincs.

Wednesday evening, this week, the electrical and industrial ex

hibition in the Coliseum at Lynn will be opened. It is the first exhibition of the kind ever given in Lynn and promises to be very interesting. Already much machinery is in place. The entire process of shoemaking will be shown, there will be an excellent display of electrical apparatus, and also miscellaneous exhibits of machinery for various purposes. An art gallery will be a notable feature of the exhibition. The governor will start the machinery on the opening night. He will be accompanied by his staff, and will be escorted from the station by the Grand Army post and the Lynn Light Infantry.

Erie Telephone further advanced from 33½ to 35⅝ at the close of the market May 28. The large earnings of late have had a favorable effect and talk on Erie is flattering. President James W. Bennett has just returned to Lowell, having spent nearly four months in a thorough inspection of the company's property in Arkansas, Texas, Minnesota, Dakota and Ohio. His report will be presented at the annual stockholders meeting, June 14. This report will show that the company's property throughout is in excellent condition. Last year 798 new subscribers were added and a dividend of 2½ per cent. was paid. There is strong talk of 3 per cent. this year, and there is the best of reasons for expecting that it will be paid. With this the case the advance in Erie Telephone stock certainly has a good basis.

The instrument account of the Bell Telephone Company for the month to April 30 shows unusual heavy returns and a falling off in net output from last year. The figures for four months are very favorable:

Month, April 20.	1887.	1886.	Increase.
Gross output	5,265	4,555	701
Returned	2,329	1,359	961
Net output	3,936	3,096	*260
Since Dec. 20.	1886-7.	1885-6.	
Gross output	21,692	17,054	4,638
Returned	9,516	8,046	1,470
Net output	12,176	9,008	3,168

* Decrease.

Bell telephone stockholders are anticipating a cash dividend before long, and the largest extra dividend yet declared is expected.

W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, May 28, 1887.

At a meeting of the Chicago Electric Club, held this week, the following officers for the ensuing year were elected: Gen. A. K. Stiles, president; C. A. Brown, B. E. Sunny, F. G. Beach and J. P. Barrett, vice-presidents; F. S. Terry, treasurer; W. A. Kreidler, secretary. C. A. Brown, F. S. Terry, W. A. Stiles, W. J. Armstrong, Wm. J. Buckley, J. P. Barrett, Charles D. Shain, B. E. Sunny, Wm. J. Lloyd and W. A. Kreidler constitute the board of managers. The next meeting of the club will be held Thursday, June 2. The club will arrange for a handsome suite of rooms for permanent quarters. It expects to have a very large membership.

The New York correspondence of the Western Electric Company has become so heavy that something had to be done to relieve the correspondence department. The company has therefore leased a special wire from Chicago to New York, which it has the exclusive use of for a certain length of time each day.

The St. Louis Western Electric Light Company has arranged for still another increase of 35 lights, the capacity now being 105 lights. The electric light plant at Salina, Kan. (Western Electric system) was successfully started this week.

The telephone exchange at Dallas, Tex., is growing rapidly. A new switch-board with an equipment of 500 lines is being built by the Western Electric Company. The infringing company there, which was once enjoined from using the Pan Electric telephones, has been enjoined again recently from using the instruments which were substituted for the Pan-Electric.

Edgewater, one of Chicago's prettiest suburbs, is to have the electric light. The Western department of the Edison Light Company, Humbird and Gorton, managers, have recently installed there an 800 incandescent light plant which will be in operation May 30. This plant will be used for lighting both the streets and residences. It is confidently predicted that quite a number of our suburban towns will shortly follow Edgewater's example.

Owing to the recent street car troubles in that city, a resolution was introduced at a special session of the Indianapolis City Council last Monday night, "Inviting the attention of persons and corporations engaged in introducing and operating electrical street railways." The resolution was referred to Committee on Street Railways.

The Brush Electric Lighting Company of Indianapolis are doing a good business. They have 148 lamps in service at present. A large number were taken down this spring as the days grew longer.

The Indianapolis Jenney Electric Company have completed and shipped a large arc and incandescent plant to Thornton, Smith & Firth, large millers, Auckland, New Zealand. The arc lamps will be used for lighting the company's wharves and yards and the incandescents for interior of mill.

Mr. Charles Nordyke, of the Jenney Co., leaves for Auckland in a few days to superintend setting up and starting the plant. The Jenney Co. have furnished something over 70 cities throughout the United States with plants for street lighting, besides numerous private incandescent plants. The company employ 80 men steadily in their shops, and are full of orders. Mr. Brainard Rorison, secretary of the Jenney Electric Company, has gone to California in the interests of his company.

Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes me the following telephone stock quotations:

Bell of Mo.	$155@$157
Central Union	50@ 51
Chicago	385@ 400
Colorado	20@ 22
Cumberland	80@ 85
Great Southern	30@ 33
Michigan	76@ 77
Rocky Mountain Bell	40@ 45
Wisconsin	105@ 107

W. A. K.

THE TELEGRAPH.

The Snow-Alley Case.—The full bench of the Massachusetts Supreme Court sent down a rescript May 20 in the famous Snow-Alley case, sustaining the defendant's exceptions. The title of the case was Chester Snow *vs.* John B. Alley, and the action was a tort to recover in trover from the defendant the value of 150 Postal Telegraph bonds of the par value of $1,000 each, alleged to have been converted by the defendant on the ground that they were obtained by fraud. The opinion is written by Judge Devens, and is of great length. In it he reviews the facts and evidence in the case, which has become familiar to the public owing to the wide publicity given to the case at the two trials which took place in Barnstable County, and states that it is the opinion of the court that the judge of the Superior Court before whom the case was tried, erred in his rulings. The verdict in the Superior Court was for the plaintiff for $102,000. George O. Hartnell and H. P. Harriman appeared for the plaintiff, and Robert G. Ingersoll, of New York, and J. M. Morton, of Fall River, for the defendant.

Telegraphic Habits.—The other night, at the New York bureau of a Western newspaper, the telegraph operator was busily engaged in transmitting the latest news, says the *Evening Sun*. It was noticed that while he manipulated the key with his right hand fingers he kept drumming on the table with a lead pencil held in his left hand. When his right hand stopped, so did the left. After watching the knight of the key several moments, a reporter ventured to remark that he seemed very nervous. The operator smiled, and said such was not the case, but that 99 per cent. of the male telegraphers accompany the transmitting movements of their right hands in various ways. Some operators drum on the table, while others tap the floor with one of their feet, like a musician keeping time to music. An operator employed by the Baltimore & Ohio Company in this city cannot transmit without holding his left hand across his face and gently patting it. Another operator duplicates the dots and dashes which his right hand forms by wiggling the lobs of his ears with the idle hand. These peculiarities are not noticeable among women telegraphers.

To Enjoin the Western Union.—Col. John C. Reiff, who is the owner of 100 shares of Western Union, has applied to the Supreme Court for an injunction to restrain the directors from issuing new bonds to be exchanged for the stocks and bonds of the leased lines which had been guaranteed by the Western Union. Mr. Simon Sterne is Col. Reiff's lawyer. In his affidavit accompanying the application for an injunction, Col. Reiff swears that the leased lines contain an immense amount of "water;" that several of the directors of the Western Union own large amounts of guaranteed stocks and bonds of the leased lines, and that the leases to the Western Union and the guarantees by the Western Union were made through a conspiracy to advance the value of the leased properties at the expense of Western Union; that the proposed exchanges, which will increase the bonded debt of the Western Union about $35,000,000, were only carried by the votes of persons heavily interested in the stocks and bonds of the leased lines, and that their votes were illegal. Col. Reiff also objects to the proposed issue of $1,200,000 of new stock by the Western Union with which to redeem the scrip dividend. The hearing upon the injunction is set down for June 6.

A Supreme Court Decision.—The U. S. Supreme Court has given a decision in the case of the Western Union Company *vs.* W. Pendleton, in error to the Supreme Court of Indiana. This was a suit brought by the sender of a telegram from Shelbyville, Ind., to Ottumwa, Iowa, to recover a penalty of $100 under a statute of Indiana prescribing the manner in which telegrams shall be sent and delivered. The complainant alleged that his telegram had been put in the Post Office at the point of destination, instead of being delivered, and that this was in violation of the Indiana statute. The telegraph company maintained that the State could not constitutionally regulate the method of delivery of a telegram in another State, because such action would be a regulation of Inter-State commerce. The court upon the authority of Telegraph Company *vs.* Texas (105 United States 460)—Pensacola Telegraph Company *vs.* Western Union Telegraph Company (96 United States 1) and other cases, holds that the attempted regulation by Indiana of the mode in which messages sent by telegraphic companies doing business within her limits shall be delivered in other States, cannot be upheld. It is an impediment to the freedom of that form of Inter-State commerce which is as much beyond the power of Indiana to interpose as was the imposition of a tax by the State of Texas upon every message transmitted by a telegraph company within her limits to other States, was beyond her power. Whatever authority the State may possess over the transmission and delivery of messages by telegraph companies within its limits, it does not extend to the delivery of messages in other States. The judgment of the Supreme Court of Indiana is reversed, and the cause remanded for further proceedings not inconsistent with this opinion. Opinion by Justice Field.

THE TELEPHONE.

No Decision Yet.—The United States Supreme Court, at its meeting on May 27, did not announce a decision in the Bell telephone case, although one was expected.

Erratum.—In Mr. Farnham's recent brief article, the letter "p" was omitted, by oversight, in the word "magneto." It should read "*magneto* bells" not "magnet bells."

Piano Tuning by Telephone.—A firm of Birmingham music dealers was lately required to tune an organ to accord with a piano in Moseley. It was impracticable to bring the instruments together, but a happy plan was at length stumbled upon. A note of the piano was struck in front of a telephone, and the sound was so accurately transmitted to the distant tuner that he was soon able to accomplish his task, and the organ was sent in season for its intended use with the piano in a concert.

Telephones Around New York.—Few people have any idea of the number of telephones in use immediately around New York. The number is not less than about 15,000. On April 1 the New York and Long Island division of the New Jersey Company had 3,438, and the New Jersey division and Newark had 3,264. New York City had 6,800, Staten Island 250, and Westchester County about 800, making 14,552 within New York City reach. Such a network of wires and service for intercommunication can be found nowhere else in the world.

A Toll Book Not Evidence.—Gen. Barney reports in his last Association bulletin as follows: "In an action brought by the New York and New Jersey Telephone Company to recover for the rent and toll services of a telephone, it appeared that the number of each toll service was entered at the time upon a slip, and these slips were sent to the main office, where the gross number of calls for each month *was entered in a book* and the slips were afterward destroyed. The Court held *that the book was not admissible in evidence*, thus reversing the judgment of a Justice of the Peace, affirmed by the Court of Common Pleas, previously given in favor of the telephone company."

Argument in Boston.—A special dispatch from Washington says: Solicitor-General Jenks, who is directing the suit of the government against the Bell Telephone Company, has been pleased to learn from District Attorney Stearns, that the demurrer filed by the Bell Company would be argued June 13. Ex-Solicitor-General Goode and Grosvenor B. Lowry, of New York, will go on to Boston to take part in the argument for the government. The government counsel feel very sanguine of success. Whether they win in the lower court or not does not seem so important to them as that they should get the case before the United States Supreme Court as soon as possible, and that is what they are striving to do.

The Gray Telephone.—A dispatch of May 24, from Washington, says: Principal Examiner Brown, of the division of electricity, in the patent office to-day heard argument on behalf of Prof. Alex. Graham Bell in opposition to an application of Prof. Elisha Gray for permission to amend his original application for patent in the celebrated telephone interference case of Bell, Gray, Edison, McDonough et al., upon which a decision adverse to Gray was rendered in 1879. Roscoe Conkling and James J. Storrow, of New York, appeared for Bell, and Casey Young, of Washington, for Gray. The latter declined to make any argument in support of his application, on the ground that the law and the rules of the patent office provide that all pending applications for patents and all amendments must be kept in the secret service of the patent office until an interference is either declared or refused. It was insisted that no notice should have been given to Bell, or to any one else, of the pending application in this case, as was done by Examiner Brown. Mr. Conkling, on the other hand, declared that the efforts of Gray's counsel to prevent a full hearing in the case were "scandalous in the extreme, and without a precedent in the history of the patent office." One of Gray's original claims was for a telephonic receiver, consisting of the combination in an electric circuit of a magnet and a diaphragm supported and arranged in close proximity thereto, whereby sounds thrown upon the line may be reproduced accurately as to pitch and quality. The change or amendment now proposed is to insert the word "metallic" before the word "diaphragm" in the above. It is stated that if the application is granted the amendment will so broaden the scope of Gray's invention as to result in a new interference and hence in a reopening of the whole case in which, in 1879, Bell was declared to be the prior inventor. Decision was reserved.

THE ELECTRIC LIGHT.

Milford, Del., talks electric light.

Yazoo, Miss.—A Brush plant will, it is said, be put in at Yazoo.

Frederick, Md.—An electric light plant is proposed for Frederick.

Greenville, Tex.—It is intended to put an Edison plant in Greenville.

Honey Grove, Tex.—There is a movement to erect a plant at Honey Grove.

Key West, Fla.—The gas company has obtained leave to put up an electric light plant.

Peoria, Ill.—The local electric light company has sold out to the Peoria Gas Light Company.

Greensboro, N. C.—The local Thomson-Houston Company will begin operations about June 1.

Union City, Tenn.—The Union City Gas and Electric Light Company was incorporated recently.

New York City.—The local Brush Company has declared a quarterly dividend of 2 per cent., payable June 1.

Clinton, Mo.—The Clinton Electric Company, having a capital of $18,000, has been incorporated by G. Hormeyer and others.

Milbury, Mass.—The Milbury Electric Company, formed by C. D. Morse and others, has a capital stock of $10,000.

Talladega, Ala., has been the scene of contest between two electric light companies, each of which wants the charter.

Winston, N. C.—The Winston Electric Light and Motive Power Company adopted recently the Brush lighting system.

Wytheville, Va.—A town vote of 275 to 6 has been recorded in favor of spending $60,000 on water and electric light plants.

Rome, Ga.—Rogers & Reynolds have contracted for an electric light plant for their brick yard, so as to run night and day.

Moline, Ill.—The Moline Electric Light Company has bought the local gas works and controls also the gas plant at Rockford, Ill.

Portsmouth, Va.—The Portsmouth Gas Company is interested in a movement for the organization of a new electric light company.

Hamilton, O.—The Hamilton Electric Light Company has been incorporated by T. Millikin and others, with a capital stock of $50,000.

Fulton, N. Y.—Thomson-Houston lights to the number of 40 have been contracted for to light the village, at the rate of $1,500 per annum.

Houston, Tex.—The Houston Gas Light Company, T. W. House, president, and T. F. White, secretary, was to decide this

week on the system of electric lighting that it will place in its works.

New Orleans, La.—It is reported that the local Brush Company will put in a Westinghouse plant, on the alternating system, of 5,000 lights.

Manhattan, Kan.—The Manhattan Electric Company has been incorporated by G. Higinbotham and others, with a capital stock of $25,000.

Feed Water Purifiers.—The Hoppes Manufacturing Company, of Springfield, O., has shipped a purifier of 350 h. p. to the Dayton, O., Edison Company.

Mr. F. W. Pope-Cox has opened an office at 330 Pine street, San Francisco, as the Pacific Coast agent of the American Electric Manufacturing Company.

Charlestown, Mass.—The new electric light station which the Charlestown Gas Company has been building at Charlestown Neck, will be completed in a few weeks.

Springfield, Mass.—The United Electric Light Company, of Springfield, Mass., has been incorporated by Gideon Wells and others, with a capital stock of $100,000.

New Haven, Conn.—The New Haven Electric Light Company have ordered another Armington & Sims engine of the Jarvis Engineering Company, of Boston.

Natchez, Miss.—Mr. Thos. Reber, of the Natchez street railway, is putting in an Edison plant to light the park at the end of the street railway, as well as a portion of the city.

Pittsfield, Mass.—The Pittsfield Electric Light Company is about to serve Lenox, six miles distant. Five hundred incandescent lights have been engaged there, one hundred and fifty of them going in the Curtis Hotel.

Manhattan Beach.—Mr. H. N. Curtis, agent of the Thomson-Houston Company, has closed a contract with "Pyrotechnist" Pain, for 35 arcs, etc., for the exhibition grounds at Manhattan Beach. The plant will be operated by a 9 × 12 Ball engine and a 50 h. p. Bigelow boiler.

Ashtabula, O.—The Ashtabula Electric Light and Power Company, just incorporated, proposes putting in a plant for lighting business houses, etc. Proposals for equipping the plant with dynamos, lights, etc., should be addressed to Mr. J. N. Stewart, owner of the street railroad in that place.

Washington, D. C.—The Jarvis Engineering Company, of Boston, have completed setting five tubular boilers with the Jarvis boiler setting for the United States Electric Light Company, Washington, D. C. This company will use the Thomson-Houston system of arc lights and the Edison system of incandescent lights.

Chattanooga, Tenn.—Messrs. Bemiss & Simonds, of New Orleans, say with regard to the report of their intention to put a plant up in Chattanooga: "We were there looking around with a view of establishing an Edison plant for incandescent lighting. Nothing, however, has yet been definitely settled about the matter."

Huntsville, Ala.—Mr. A. C. Green, agent for the Indianapolis Jenney system, has closed a contract with the Huntsville Electric Light Company for a plant, including power, of 30 arcs and 300 incandescents. The work of erection, etc., is now going on under his superintendence, and the plant will be in operation some time in the latter part of June. A Ball automatic engine is to be used.

Kankakee, Ill.—Mr. W. W. Hatch writes us that the plant of 30 Western electric lamps for street lighting there is operating very satisfactorily, and that as soon as an arrangement can be made for more power, more lights, to the number of 30 or 50, will be added for commercial purposes. The Kankakee Illuminating Company, which is now organizing, will, it is understood, carry on this work.

Minneapolis, Minn.—The Globe Electric Light and Power Company, of Minneapolis, have completed their incandescent plant at Red Wing, Minn., and are now supplying 300 lights to their patrons. They are also furnishing a large number of arc lights for street purposes. Mr. E. L. Castle, who had charge of the construction of the plant, leaves for St. Cloud, Minn., where the company intends putting in a plant.

New York City Lighting.—At their last meeting, the Aldermen adopted a report and resolutions to the effect that the gas commission for lighting the city be requested to contract for lighting the entire city with electric lights instead of gas; also, that permission and authority be granted to the Waterhouse, the American, the Ball, the Mount Morris, the Harlem and the North New York electric lighting companies to erect poles and string wires for electric lighting purposes.

Busy Around New York.—The following are recent local contracts of the Edison Company: Produce Exchange, increase, 400 lights; Western Union Company, 400; Swarzschild & Sulzberger Refrigerating Company, Forty-fifth street and First avenue, 900; Vogel Brothers, Eighth avenue and Forty-second street, 400; Harmonie Club, Forty-second street, 500; Gallatin National Bank, Wall street, 250; Steamer "Olivette," 325; Babbitt factory, Washington street, 100; Manhansett House, Shelter Island, 150.

Puebla, Mexico.—Work on the long line from the falls of the Atoyec River to Puebla, referred to in a late issue of THE ELECTRICAL WORLD, under the head of "The Electrial Industries of Mexico," has been commenced, and it is expected that the line will be finished before the rainy season sets in. The plant is to have a capacity of 135 lights of 1,200 c. p. The company intends putting in large generators, to be used in the daytime on a motor circuit, as it has the use of the falls day and night, and there is no scarcity of water-power.

Philadelphia, Pa.—On the anniversary of the birth of Stephen Girard, May 20, the directors of the college illuminated the grounds with electric lights. Seven iron towers 125 feet high are being erected in different parts of the inclosure, and already some of them are in position. From the top of these towers clusters of lights, five in each tower, will shed their brilliance over the grounds and the neighboring streets. The towers are located so as to illuminate the sidewalk around the high wall. The Fort Wayne Jenney system is used.

Galveston, Tex.—The Brush Electric Light and Power Company, of Galveston, Tex., has closed a contract with the Edison Electric Light Co., of New York, for an additional incandescent light plant, with a capacity of 2,000 lights of 16-candle-power each. The new machinery is to be in operation within three months from date. This is one of the largest incandescent plants in the South, and the lights will be introduced into every room of the Beach Hotel and many private residences. The local company referred to is one of the oldest organizations of the kind in the country, having been in operation for the past six years. It has a capital of $150,000.

Lighting up New York City.—The Brush Company has been awarded, after long discussion and fight, a contract for 324 city lights at 25 cents a night per light. In a recent letter to one of the city papers, President W. L. Strong, of the company, says: "We are just finishing a perfectly fire-proof station capable of furnishing 4,000 lights, which in connection with our old station in Twenty-fifth street, gives us a capacity of 5,000 lights; the entire cost of the two stations exceeds one million dollars. Within the coming sixty days we will be prepared to make that number of lights." Mr. Strong denies emphatically that the Brush Company, first in the field and still full of strength and life, has pooled its issues with anybody or is working to create or continue any monopoly.

The United States Electric Lighting Company has issued a new catalogue which is certainly one of the most artistic and sumptuous productions of its kind. On the front cover is a finely executed Promethean figure, in whose right hand attached to wires from the clouds underfoot is an incandescent lamp aglow. On the back cover are views in color of the factory and apparatus of the company. In the body of the pamphlet is a sheet 18×20, showing in a series of wood engravings, skillfully grouped, the details of the arc and incandescent systems and the various ways in which both lights are used. Elsewhere throughout the pamphlet are illustrations of the machines, lamps, etc.; and the descriptive letterpress is remarkably well done. The appearance of this handsome work marks the removal of the company to its new offices in the Equitable Building, which it lights so strikingly and successfully.

Woonsocket, R. I.—The Woonsocket Electric Machine and Power Company, which has long been cramped in its present quarters, has purchased the Bernon Mill estate from Messrs. Wyman & Chace. Here the central lighting station will ultimately be, and it will be one of the finest in New England. It is the intention of the purchasers to let portions of the mill buildings to manufacturing jewelers, manufacturers of boots and shoes and others. This will be the means of giving employment, at good wages, to a large number of help, and will be a great advantage over the system observed for years in the running of these mills on cotton goods, prints, mostly employing a comparatively poorly-paid class of operatives, the majority of whom were children. Every encouragement will be given by the new owners to those desiring to start new industries, and as they increase, as undoubtedly they will, new buildings will be erected.—*Manufacturers' Gazette.*

City of Mexico.—A correspondent, writing under date of May 11, says: The agents of the Edison Company here—who are Mexicans—made an exhibition of that system at the rooms of the "Casino Español" last Saturday, and it was the most brilliant display of incandescents I ever saw, the lamps being pretty well crowded together. The new "Bull Ring" on the Paseo was recently the scene of one of the most lively bull fights that ever took place in Mexico. It occurred on the 28th of April, in the evening. The ring was lighted by seven Brush lights from the city circuit. Twelve horses were killed by the first bull, and in the course of the evening four of the fighters were injured—one, called "Cuatro Dedos" (Four Fingers), quite seriously. From a Mexican standpoint the fighting by night was a grand success, but the fighters were not so enthusiastic over the "new departure" as were the spectators. An order has recently been given for a 500-light incandescent machine to be operated by two private gentlemen as a local company in this city. A contract has just been made to light the town of Tacubaya, a few miles from the capital. The plant is to consist of thirty 2,000 c. p. arc lights and one hundred 16 c. p. Thomson-Houston incandescent lamps.

The American Company.—The New Haven *Real Estate Record* thus chronicles the removal of the American Electric Manufacturing Company's plant to that city: "The sale of property on Winchester avenue, which was formerly the Judson Brothers' packing house, to the American Electric Manufacturing Company of New York has at length been consummated. The sale was announced some seven months ago, but owing to some formalities which had to be passed through in New York, the actual sale has just taken place, and the deeds were recorded last week. The property consists of the large four-story brick building on the west side of Winchester avenue, erected in 1875 by Judson Brothers, afterwards the Judson Brothers Packing and Provision Company. The property was heavily mortgaged to the Chelsea Savings Bank, which foreclosed, and has been in possession until now. The deeds were made out in the name of Edwards H. Goff, the president of the company, whose headquarters are at No. 146 Broadway, New York. The company manufactures the dynamos, electric lamps, etc., used in the Fuller-Wood system of electric lighting. The manufacturing department of the concern will be transferred to New Haven, and operations begun at once. About 200 hands will be employed. This will make an important addition to the manufacturing interests of New Haven, and will have the effect of increasing still further the activity in building and real estate, which has existed in that part of the city for some time past."

APPLICATIONS OF POWER.

San Francisco.—A power station is being established in San Francisco, special circuits being run for motors.

For Experimental Use.—The London Society of Arts has added to its apparatus an Immisch motor for lecture and other work.

Cleveland, O.—It is reported that the Cleveland Motor Company are very busy placing and selling motors, and are about to equip an electric power station.

Woonsocket, R. I.—The Woonsocket electric light company is to supply the power for the electric railway now building in that town. It has increased its capital from $50,000 to $100,000.

Austria.—Siemens & Halske, who are to build the electric railway between Lend and Gastein, have obtained a concession to extend the road as far as Boeckstein.

New York City.—The Daft power plant, 13 Spruce street, is very busy meeting the demand for motors and for electric power, and has lately had to increase its steam plant, etc. It is also increasing its area of service, and is receiving excellent reports from its motors, which are now running on all kinds of work.

Scranton, Pa.—The president of the electric railway (Van Depoele system), reports under date May 24: "Our three cars carried just about an even 10,000 people last week, and worked splendidly all the time." The traffic is now increasing so rapidly that two 25 h. p. motors have been called for, and further generating plant.

On Board Steamers.—The Sprague Company has just closed contracts for motors to propel fans for ventilating the saloons, staterooms, etc., of several of the Wilmington steamers. In all probability this method of improving the 'tween deck atmosphere of ocean steamers will be generally adopted, and it is already talked of for other lines.

Fulton Street.—The North & East River Railroad Company, to operate under the Bentley-Knight system, has bought the Fulton street franchise from the city at 35 per cent. of the gross receipts annually, in addition to the 3 per cent. for the first five years and 5 per cent. yearly thereafter. The Bentley-Knight Company will begin their construction work immediately.

The New York Belt Line.—Last week a destructive fire occurred in the stables of the Belt Line Company, Tenth avenue and Fifty-third street. Over 1,200 horses were burned to death, and the motive power of the line was thus completely annihilated at one blow. The management have been quite busy since the fire discussing various methods for operating the line, and will try cars with storage batteries and electric motors, and some system for supplying current from a conduit to the motor. The experiments will begin forthwith.

San Francisco, Cal.—Prof. N. S. Keith, who has had charge of the construction of the new electric railway motors for the Folsom street line, told a reporter yesterday that the trial trip of the first electric locomotive built for the road would probably be made within thirty days. The conduit iron is being prepared at the Pacific Roller Mills, and when completed it will be laid from Nineteenth to Twenty-sixth street, near Folsom. The steam engine used for the generation of the electricity will be set up at Nineteenth street. Two of the locomotives under construction were seen by a reporter yesterday afternoon. The frame-work has been completed, and the wheels, shafts and dynamo put in position. The power is applied to the shaft from the dynamo on each locomotive by a band running to a horizontal revolving wheel four feet in diameter, which is placed above the forward car-wheel shaft, to which it is connected by a mitre gear. The electricity is conveyed to the car dynamo by a conductor which roughly corresponds with the ordinary cable. The maximum speed of the electric locomotive intended for use on Folsom street is twelve miles an hour, although they could be readily made to go even much faster by an increased power of electric generation. The regular running speed will be eight miles an hour, which is the limit fixed by municipal law. The motors built here for this purpose are said to be a great improvement over those in use in Denver and other cities. There is a saving of about 60 per cent. in expense as compared to that of cable railways.—*San Fran. Chronicle.*

MISCELLANEOUS NOTES.

Brackets and Pins.—Freeman & O'Neil, of Claremont, N. H., have sold their machinery for making telegraph pins and brackets to a Chicago firm. In seven years they made over 14,000,000 pins and a proportionate number of brackets.

Distribution by Transformers.—A pamphlet has recently been printed at Buda-Pesth on "Distributing Electricity with Transformers." It is devoted to the Zipernowsky-Déri-Blathy system, and consists of a paper presented in September, 1886, to the Birmingham meeting of the British Association for the Advancement of Science, by Charles Zipernowsky. At this juncture the pamphlet is of unusual interest.

Appreciation in Italy.—Our esteemed Italian contemporary, *L' Elettricita*, pays us the compliment of reproducing from our pamphlet on the thirteen years growth of THE ELECTRICAL WORLD, the illustrations of the various departments. It also devotes a large portion of its space to a translation of the historical sketch, treating it as typical of electrical enterprise and electrical developments in America.

A Queen's Jubilee Celebration.—A movement is on foot in electrical circles for a celebration of Queen Victoria's jubilee, on June 20 or 21. There are many electricians of English birth or descent in this country who would like to participate in such a movement, and to carry out the idea, therefore, a committee has been formed as follows: Mr. G. G. Ward, Chairman, and Messrs. Leo Daft, Samuel Insull, T. C. Martin, and W. M. Callender, Secretary, Aldrich Building. The celebration will probably take the form of a little dinner, followed by an amateur musical entertainment and speeches. The dinner, exclusive of wine, will cost about $2 to $3 per cover. It is believed that in this way a most enjoyable evening can be spent by the celebrants and their American friends. All desirous of participating should communicate with Mr. Callender, or with any of the members of the committee as above.

Electricity in the Home.—In a recent private letter to the publisher of this paper, Mr. F. A. Kennedy, the president of the well-known biscuit and cracker manufacturing firm of F. A. Kennedy Company, of Cambridgeport, Mass., says: "The birthplace of the telephone is only a stone's throw from our home. I was so much pleased with the telephone that I put up a private wire from my home to the factory, about 2½ miles. This was the second telephone line built in Cambridge, the first one being that which was given to the city by Mr. Gardiner Hubbard, father-in-law of Mr

Bell. I have nearly all the electrical appliances which are of any use in my home—the burglar alarm, electric light, electric gongs about the place to call the help, etc. My son, who is at school, also has a Morse instrument in his room which connects with the homes of several of his schoolmates, and he is quite an expert in using it." This is an item which is not only interesting in itself, but which goes to show how familiar people are becoming with the use of electricity in the household.

SPARKS AND FLASHES.

Death to Book Agents.—Dr. Cornelius Herz, a Frenchman, has invented a telephone which costs 62½ cents. Wherever the ordinary electric button can be used the telephone button can be introduced. It will be possble to give or receive instructions by it, to show who is knocking at the door, to communicate, in short, by speaking as well as by ringing.—*Philadelphia Ledger.*

PERSONALS.

Mr. George Westinghouse, Jr., has presented to the Stevens Institute of Technology a full outfit, consisting of an alternating current dynamo, converters of various sizes, etc.

Mr. Madison Buell, at the last meeting of the Buffalo Electrical Society, gave that body a thrilling account of a balloon trip made by himself and Messrs. Kitton, Terry and Finn, and proved himself to be the Jules Verne of the profession. As a play of fancy, combined with a command of scientific information, the paper is highly creditable. Mr. Buell should expand it with a novel.

Mr. W. Forman Collins, a young English electrician of good training, and but recently arrived in this country, has obtained a position as electrical engineer with the Hawkeye Electric Manufacturing Company, of this city. Mr. A. E. Braddell, also of England, has made an engagement with the Electrical Accumulator Company, having had experience in that line. Both gentlemen are likely to do extremely well.

Mr. Edison.—A special dispatch from Orange, N. J., says: "Thomas A. Edison, who has recently purchased a large tract of land on Lakeside avenue, has had preliminary plans drawn for what it is believed will be the largest and most complete laboratory in the country. The new building is to be of brick, three stories high, with a ground plan 60 × 250. The lower floor will contain a library of several thousand volumes on scientific subjects. It will be handsomely furnished in hard woods. In the large room, 60 × 200, will be placed the boilers, engine and heavy machinery. The two upper floors will be divided into smaller rooms for experimental purposes."

BUSINESS NOTICES.

Detroit, Mich.—The Detroit Electrical Works are making some very fine office and annunciator wire. The finish is highly spoken of.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolts, cap and set screws, taps, dies, files, twist drills, brass and rubber in tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Carbons.—The angry feelings of a good many electric light men were aroused when they heard of the advance in prices of carbons, but now they begin to see that this step was necessary to save the manufacturers from failure. No one could expect that carbon makers, any more than the makers of any other goods, could continue to sell their product at less than cost.

Manufacturing Carbons has been one of the most unsatisfactory branches of electric lighting. Some years ago a good deal of money was made in the business, but it is believed by those who ought to know that, without exception, all of the companies have since sunk in it, not only what money they made, but a larger part of their capital. Still the manufacture of carbons appears to have a fascination for outsiders, and there are plenty who seem to be willing to put their money into the business upon some visionary theory of there being "millions in it."

Augusta, Ga.—One of the most progressive cities in the South is Augusta, Ga. There is as much progress in manufacturing there as in any part of the South. Land is cheap, and manufacturing facilities are better than in any place in the South. There is abundant water-power, and fuel is cheap. Most of the steam plants are using the well-known Jarvis boiler setting, and Mr. J. H. McKenzie, Augusta, is agent. Among his customers are the Sibley Mills, J. P. King Manufacturing Company, W. E. McCoy, Foster & Doughty Cotton Compress Company, Enterprise Cotton Compress Company, Arctic Ice Company, and Augusta Ice Company. The last concern uses Alabama slack coal and wet sawdust for fuel, also cotton-seed hulls.

The slight advance in the price of carbons made by some of the companies will, the managers of these companies feel sure, result in a great deal better and more uniform carbon. A few years ago carbons sold at $100 a thousand, and at one time they commanded even a higher price. Owing, however, to the bitte competition among carbon manufacturers, prices kept tumbling until they reached a point where the less business a factory did the more money it made, or, at least, the less it lost. It could not be expected that carbon manufacturers would continue indefinitely to sell carbons below cost. Electric light superintendents have been so used, however, to buying carbons at the ruinously low prices, that they cannot understand why they should now be called upon to pay higher rates. The fact is, however, that for a first-class carbon, one that will give satisfaction both to the superintendent and his customer, the price decided upon by the manufacturers is very reasonable. If the companies by their combined efforts can make a good carbon at a price that will enable them to sell it at a lower price than is now charged, they will be very glad in the protection of their own interests to lower the prices. In the meantime superintendents can depend upon getting from us good carbons, which will be shipped in any quantity on the day the order is received.

Quotations, or any further information, can be obtained by addressing E. C. Hawks, Agent, 90 and 91 Wilshire Building, Cleveland, O.

STOCK QUOTATIONS.

The following list, compiled by Mr. W. H. Baker, member New York Stock Exchange, 16 and 18 Broad street, gives the current quotations of electrical stocks:

May 31, 1887.

TELEGRAPH.	Bid.	Asked.
Am. Dist.	.....	87
Am. Tel. & Cable	76	78
Cen. & So. Am.	96	100
*Com. Tel	.....	.....
*Gold & Stock	.....	.....
*Inter. Ocean Tel.	.....	.....
N. Y. Mutual	81	82
Pac. & Atl.	48	54
*Postal T. & C.	.....	.....
South. & Atl.	68	75
W. U. Tel.	77¾	77⅞
W. U. Scrip	76	.....
W. U. Bonds	117	.....
Mut. U. Bonds	86½	87
TELEPHONE.		
Am. Bell	222	224
Am. Speaking	110	120
Erie	35	35½
*Hudson River	.....	60

TELEPHONE.	Bid.	Asked.
Mexican	1⅝	1¾
*N. Y. & N. J.	87	92
N. Y. & Pa.	.....	.....
New England	45¼	45¾
*Southern Bell	125	135
ELECTRIC LIGHT.		
*Am. Electric	.....	.....
*Brush	.....	.....
*Brush Ill	.....	.....
*Consolidated	.....	.....
*Daft	.....	.....
*Edison	137	140
*Edison Ill	99	100
*Edison Isolated	.....	.....
*United States	40	50
*U. S. Ill	90	95
MOTOR.		
*Daft	.....	.....
*Sprague	.....	.....

* These stocks are so seldom dealt in that it is difficult to give prices at which they can be bought or sold. The figures given are as near as can be ascertained.

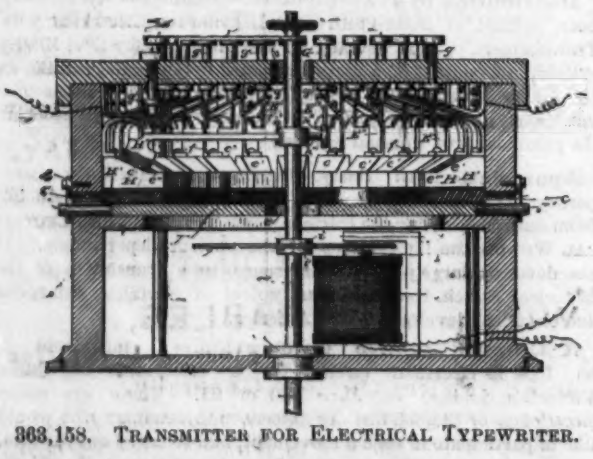
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MAY 17, 1887.

363,079. Electrical Device for Operating Steam Whistles; W. M. Pease, of Pittsburgh, Pa. Application filed May 24, 1886. Mechanical devices which are operated by an electric current to open and close a whistle valve. See illustration.

363,106. Method of, and Apparatus for, Forming Armature Cores; F. Wynne, of Westminster, County of Middlesex, England. Application filed Sept. 18, 1886. The invention consists in so shaping the band of iron of which the armature core is wholly or partly made up that, in the process of winding, it may form the pockets for the reception of the bobbins of the armature.

(1) 363,126. Self Exciting Alternate Current Electric Generator; (2) 363,127. Safety Contact Brush for Dynamo-Electric Machines; (3) 363,128. Electric Dynamo Machine; (4) 363,129. Method of and Apparatus for Detecting Short Circuits in Dynamo-Electric Machines; J. W. Easton, of New York, N. Y. Applications filed respectively July 3, 1886, March 17, 1886, July 3, 1886, and Sept. 4, 1886. (1) The invention relates to



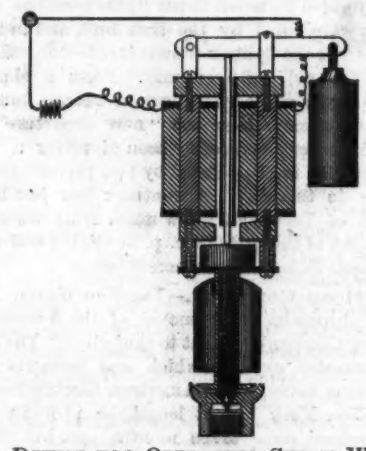
363,158. TRANSMITTER FOR ELECTRICAL TYPEWRITER.

the construction and organization of circuits for causing an alternate current generator to maintain its own field of force. (2) Means for preventing an interruption of the current when a brush is removed from the commutator. (3) The object is to so organize two machines and their circuits that currents of different character may be derived therefrom. (4) An induction device is applied to some point upon one of the field magnets in such manner that variations in magnetism which will be occasioned by reason of the short circuit shall produce an electric current in an independent circuit, and in employing this current to operate some indicating device. See illustration.

363,158. Transmitter for Electrical Type-Writers; J. F. McLaughlin, of Philadelphia, Pa. Application filed Nov. 12, 1886. This is a type-writing machine which is adapted to be used separately as such, or to be connected electrically with another machine at a distance for the purpose of transmitting impulses due to the striking of keys from the former to the latter in such a manner as to produce type-writer work on the tablet of the latter machine. See illustration.

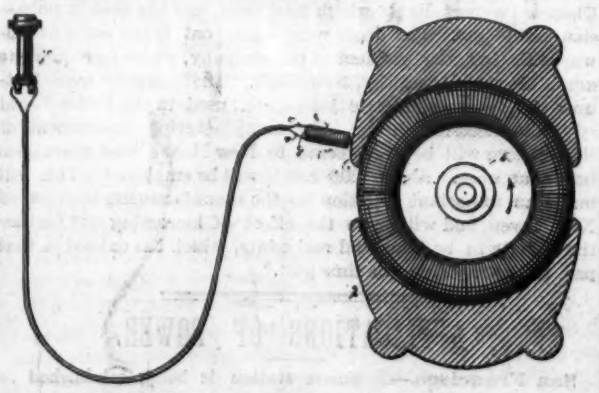
363,182. Covering Insulated Electric Conductors; J. Tatham, of Philadelphia, Pa. Application filed Aug. 28, 1886. In the process of sheathing insulated conductors with lead, it has been found that the intense heat injures the insulation. This invention designs to prevent such injury. See illustration.

(1) 363,183. Electric Switch; (2) 363,184. Automatic Commutator Adjuster; (3) 363,185. Alternating Current Electric Motor; (4) 363,186. Alternating Current Motor Device; E. Thomson, of Lynn, Mass. Applications filed respectively Nov. 27, 1885; Aug. 25, 1886; Jan. 26, 1887, and Jan. 26, 1887. (1) The



363,079. DEVICE FOR OPERATING STEAM WHISTLES.

object sought is simplicity of construction, at the same time securing the benefits arising from the opening of the switch with a quick motion, so as to prevent burning of the contacts. (2) Means for automatically adjusting the commutator in such a



363,129. SHORT CIRCUIT DETECTOR.

way as will cause the brushes to follow the changes in the neutral line. (3) See ELECTRICAL WORLD of May 28. E. Thomson, "Alternating Current Phenomena." (4) An alternating current coil acting directly to induce currents in the closed circuit conductor is employed.

363,188. Telegraphy; F. Van Rysselberghe, of Brussels, Belgium. Application filed June 5, 1886. This inventor contemplates sending over a single line, both "harmonic" or "tone," and Morse, or the ordinary messages simultaneously.

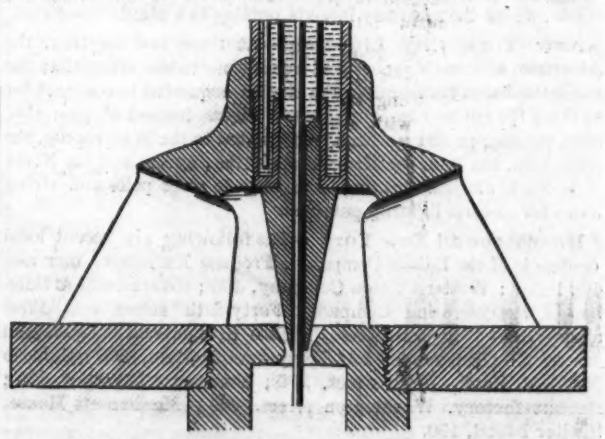
363,249. Mechanical Telephone; J. Lauhoff, of Detroit, Mich. Application filed Aug. 21, 1886. Details of construction tending to increase the efficiency of mechanical telephones.

363,250. System of Electrical Distribution for Railways; W. J. McElroy, of Pittsburgh, and J. D. Nicholson, of Allegheny City, Pa. Application filed Sept. 27, 1886. An insulated conductor is buried in the earth and branches are run off at regular intervals having exposed terminals. The car is provided with a bridge long enough to be in contact with two of the terminals at all times.

363,290. Electrical Matting; A. H. Freeman, of New York, N. Y. Application filed Oct. 8, 1886. A matting which, when stepped upon, will complete an alarm circuit.

363,304. Pocket Battery; L. T. Stanley, Brooklyn, N. Y., Assignor to Augustus N. Lindsley, of Orange, N. J. Application filed March 22, 1886. The combination, with a portable case, of an induction coil and battery, the battery having a zinc element carried by an insulating reversible plug or stopper adapted to close the battery cell with the zinc either in or out at the same time.

363,320. Process of and Apparatus for Working Metals by the Direct Application of the Electric Cur-



363,182. COVERING INSULATED CONDUCTORS.

rent; N. De Bernardos and S. Olezewski, of St. Petersburg, Russia. Application filed Dec. 3, 1885. By this process metal may be melted, bored, engraved or otherwise worked.

(1) 363,332. Device for Attaching and Detaching Electric Lamps; (2) 363,333. Indicator for Electric Lighting Systems; (3) 363,334. Electrical Switch; W. J. Hammer, of Boston, Mass., Assignor to himself and F. R. Upton, of Orange, N. J. Applications filed, respectively, Nov. 24, Dec. 16 and Dec. 30, 1886. (1) This is a rod having a pair of jaws at one end for grasping the lamp globe, and also provided with means for operating the jaws. See ELECTRICAL WORLD, Jan. 29, 1887. (3) Claim: The combination, with a three-wire circuit of a compensating system of electrical distribution, of a differential indicating instrument affected positively by the current in the positive and negative conductors of said circuit, substantially as set forth. (3) In this switch a large number of points make or break the circuit simultaneously.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patent issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.